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Division of Fish and Wildlife/IDNR
402 W. Washington Street, W-273
Indianapolis, IN 46204

# MONITORING STUDY FOR THE TURKEY CREEK WATERSHED LAND TREATMENT PROJECT AREA

## STEUBEN COUNTY, INDIANA

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**Prepared For:**
Steuben County Soil and Water Conservation District
c/o Kelly Bushong
Peachtree Plaza 200
1220 N 200 W
Angola, Indiana 46703-9171
(219) 665-3211

**Prepared By:**
J.F. New & Associates, Inc.
c/o Cornelia Sawatzky
708 Roosevelt Road
Walkerton, Indiana 46574
(219) 586-3400

## EXECUTIVE SUMMARY

In the spring of 2001, the Steuben County Soil and Water Conservation District (SWCD) received funding from the Indiana Department of Natural Resources (IDNR) Division of Soil Conservation Lake and River Enhancement (LARE) Program to collect chemical, biological, and habitat baseline data in the Turkey Creek Watershed land treatment project area. Various Best Management Practices (BMPs) are planned for implementation in the watershed through the Watershed Land Treatment portion of the LARE Program. The Steuben County SWCD desired baseline stream data that can be used in the future to determine the success of implemented projects.

The Turkey Creek Watershed is part of the much larger St. Joseph River Basin, a drainage of Lake Michigan. Turkey Creek converges with the Pigeon River just north of the Turkey Creek Watershed in the Pigeon River Fish and Wildlife Area. The Pigeon River converges with the St. Joseph River which eventually empties into Lake Michigan in St. Joseph, Michigan. The study area is part of the Northern Lakes Natural Region (Homoya et al., 1985) where Wisconsin-age glaciers carved out the rolling topography and numerous lakes that characterize the area. Some of the lakes in the Turkey Creek Watershed historically and currently foster populations of state endangered cisco, the only salmonid fish native to in-land waters of Indiana.

Chemical and biological data for Mud Creek, a tributary to Big Turkey Lake, and Cochran Ditch, an inlet to Little Turkey Lake, was collected in the spring and fall of 2001. Sampling event timing was targeted at collection of filter/scraper-type organisms in the spring and shredder-types in the fall. Habitat quality and resources were assessed during the spring sampling event.

Although the general chemical data collected during the study indicate that minimal water quality conditions are sufficient for aquatic biota, assessment of the biota itself and of habitat conditions indicates impairment. Macroinvertebrate Index of Biotic Integrity (mIBI) scores ranged from 1.4 to 3.0, scores indicative of a moderately to severely impaired insect community. Pollution-tolerant organisms dominated the samples, and smaller quantities of insects were collected when compared to healthier systems. In general, habitat resources were also less than optimal. Pool-riffle-run development and morphological channel characteristics necessary for healthy biotic communities were found to be degraded in the sample reaches. The source of impairment within stream reaches is believed to be related to non-point source pollution which results in sediment and nutrient loading. High rates of pollutant loading can reduce macroinvertebrate survival and can result in habitat impairment.

Based on data collected during the study, relevant management recommendations include: 1) implementation of planned BMPs; 2) coordination of watershed activities and management with other state and local agencies like the county drainage board; 3) monitoring program continuation; 4) extension of management to the watershed level; and 5) provision of information and education to landowners in the watershed.

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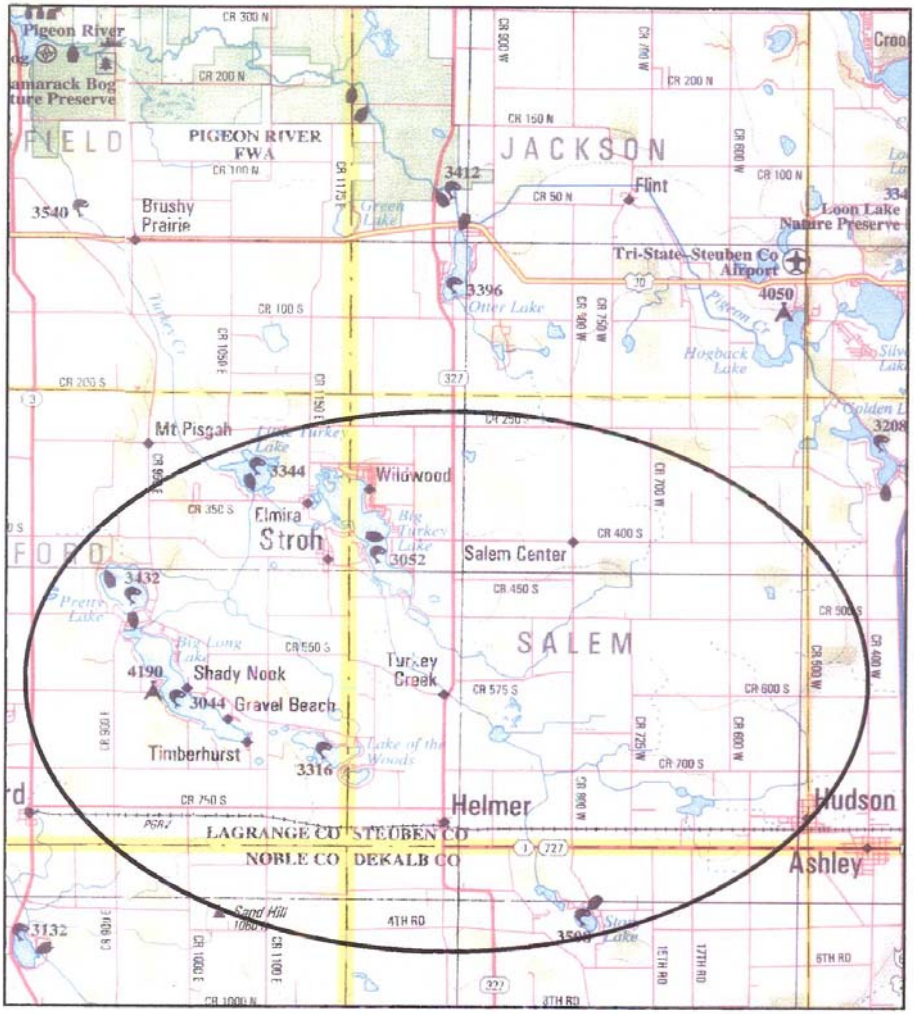
## INTRODUCTION

The Turkey Creek Watershed Land Treatment Project Area is located in LaGrange, Steuben, Noble, and Dekalb Counties in Indiana (Figure 1) and is 32,282 acres (13,070 ha) in size (Figure 2). Two main streams drain 88% of the area: Turkey Creek and Mud Creek. The watershed lies along the northeastern edge of the Northern Lakes Natural Region (Homoya et al., 1985). Numerous freshwater glacial lakes characterize this Natural Region. The Story Lakes, Hayward, Limekiln, Henry, Taylor, McClish, Lake of the Woods, Big Long, Mud, Pretty, Big Turkey, and Little Turkey Lakes are some of these glacial basins formed during the most recent Wisconsin glaciation about 15,000 years ago. Historically, bog, marsh, lake, sedge meadow, prairie, and deciduous forest community types covered the area. Currently, land use within the watershed is primarily agricultural (61%). Other land uses include open water and wetlands (14%) and grasslands (13%). About 7% of the watershed is forested (Harza Engineering Company, 1990).

The Turkey Creek Watershed area has been the subject of a sizeable amount of research (Table 1). Most of the studies have been aimed at protecting and enhancing the beneficial uses of the numerous lakes within the drainage basin. According to Indiana Clean Lakes data (IDEM, 2000), most of the lakes within the basin are eutrophic to hypereutrophic, and the Big Turkey and Little Turkey Lake Enhancement Feasibility Study (Harza Engineering Company, 1990) suggested that best management practices (BMPs) be implemented and wetland filters be constructed within the watershed before in-lake restoration processes be considered. The Watershed Land Treatment Program administered by the Indiana Department of Natural Resources (IDNR) Division of Soil Conservation funded the current study in order to gather baseline biological data at a watershed level before best management practice implementation in the immediate area ensues.

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**Scale: 1" = 1.87 Miles**

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**FIGURE 1. Project Location Map**
**Monitoring Study for the Turkey Creek Watershed**
**Land Treatment Project Area**
**Steuben County SWCD**
**LaGrange and Steuben Counties, Indiana**

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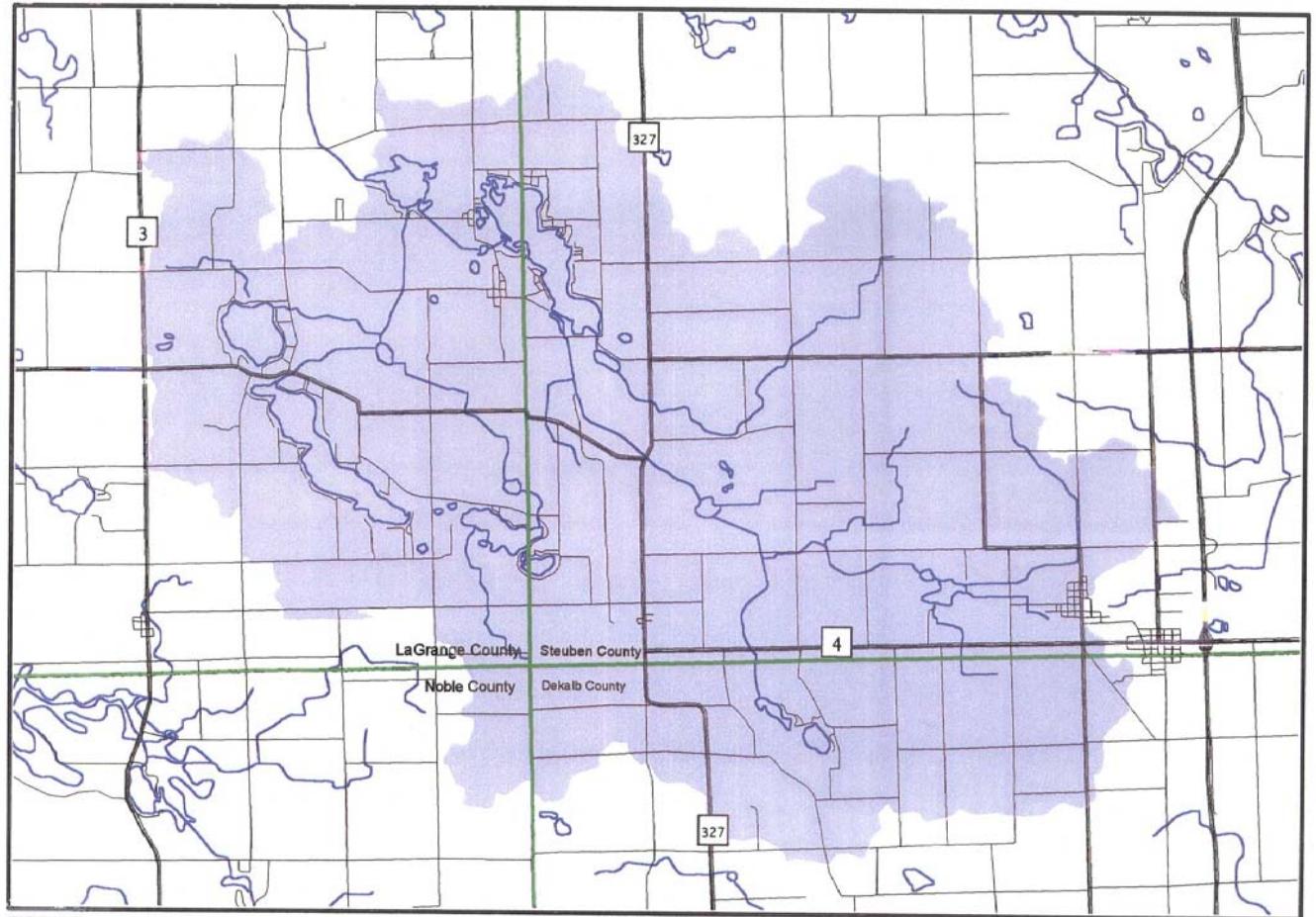


FIGURE 2.
Turkey Creek Watershed

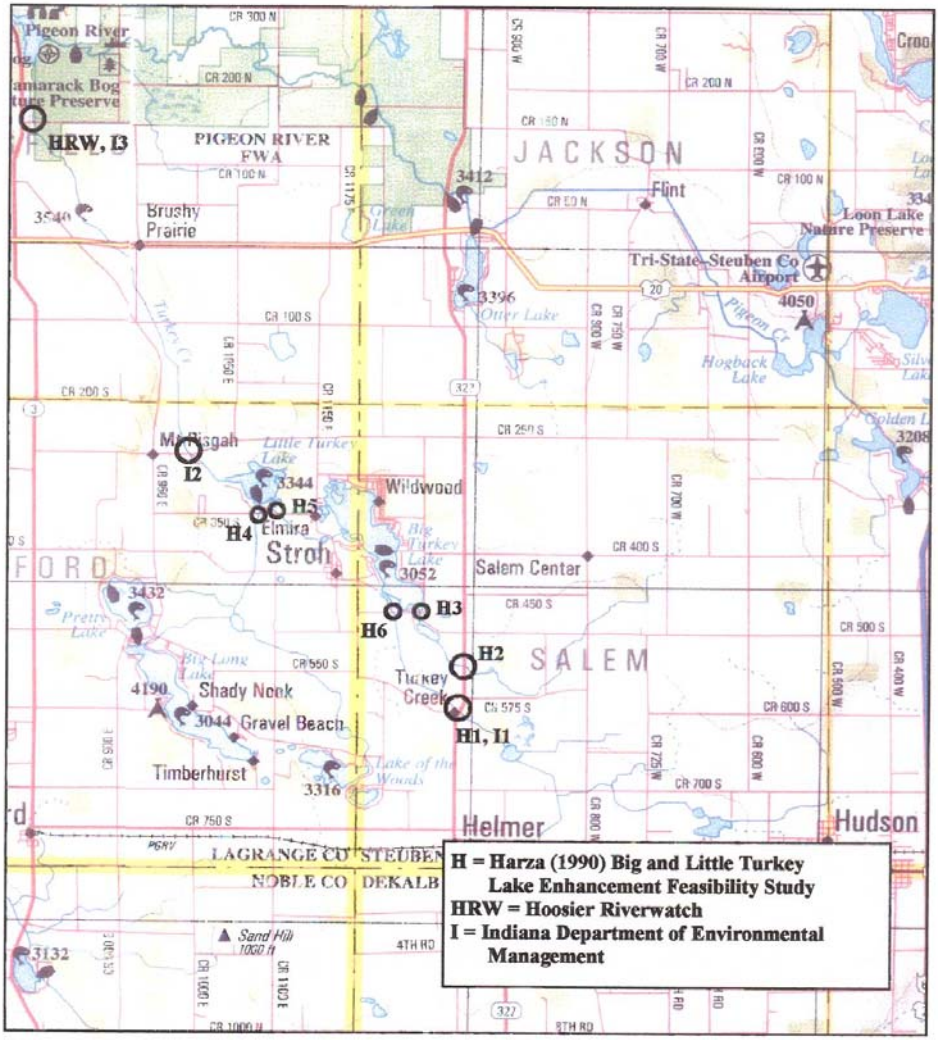


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**FIGURE 3. Historical Study Locations Map**
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**TABLE 1. Research and investigations conducted in the Turkey Creek Watershed from 1968 to present. An asterisk (*) following the year indicates biological data collected from streams included in this monitoring study. This data will be discussed in greater detail in the following historical data section.**

| Year | Entity | Study/Investigation |
|---|---|---|
| various | IDNR | Fish community and macrophyte survey in Big Turkey Lake |
| various | IDNR | Fish community and macrophyte survey in Little Turkey Lake |
| various | IDNR | Fish community and macrophyte survey in Upper and Lower Story Lakes |
| various | IDNR | Fish community and macrophyte survey in Lake of the Woods |
| various | IDNR | Fish community and macrophyte survey in Big Long Lake |
| various | IDNR | Fish community and macrophyte survey in Pretty Lake |
| 1990* | HEC | Big and Little Turkey Lake Enhancement Feasibility Study |
| 1990* | IDEM-BSS | Collection of macroinvertebrates and calculation of mIBI for Turkey Creek at intersection with SR 327 |
| 1991* | IDEM-BSS | Collection of fish and calculation of IBI for Turkey Creek at intersection with CR 275 S upstream of bridge |
| 1991* | IDEM-BSS | Collection of fish and calculation of IBI for Turkey Creek at intersection with CR 150 N downstream of bridge |
| 1991* | IDEM-BSS | Collection of fish and calculation of IBI for Turkey Creek at intersection with SR 327 |
| 1999 | IDNR | Survey of fish harvested at Big Turkey Lake |
| 2000 | IDEM-BSS | *E. coli* and water quality sampling of Turkey Creek and Story Lake |
| 2000* | HRW | Macroinvertebrate collection, water quality analysis, and calculation of a water quality index |
| 2000 | IDNR | Mussel collection in Big and Little Turkey Lakes |
| 2000 | IDEM-CLP | Clean Lakes Program Assessment of Big Turkey Lake, Little Turkey Lake (Steuben Co.), Big Long Lake, Henry Lake, Lake of the Woods, Little Turkey Lake (LaGrange Co.), McClish Lake, and Pretty Lake |

IDNR = Indiana Department of Natural Resources
HEC=Harza Engineering Company
IDEM-BSS=Indiana Department of Environmental Management-Biological Studies Section
HRW=Hoosier Riverwatch
IDEM-CLP=Indiana Department of Environmental Management-Clean Lakes Program
mIBI=macroinvertebrate index of biotic integrity
IBI=Index of Biotic Integrity

## HISTORICAL DATA

### Stream Water Quality Data

Stream water quality samples were collected at six locations (Figure 3) during the 1990 Big Turkey and Little Turkey Lake Enhancement Feasibility Study (Harza Engineering Company, 1990). Two of these sites on Mud Creek (Figure 3, H2) and on Mud Lake Creek (Figure 3, H4) are close to Sites 1 and 6 sampled during the current study. Table 2 presents selected parameters of which some measurements exceeded water quality standards and are of concern in some of the streams.

**TABLE 2. Selected Turkey Creek Watershed stream water quality parameters as sampled by Harza Engineering Company (1990). Measurements that appear in bold exceed recommended standards for healthy aquatic ecosystems. Although Indiana currently has no standard for phosphorus, it is generally accepted that TP concentrations above 0.03 stimulate algal production. No state standard for TSS exists either, but research suggests that concentrations exceeding 90 mg/l are detrimental to fish survival and reproduction (Waters, 1995).**

| Site | Location | OP (mg/l) | TP (mg/l) | % Ortho | TSS (mg/l) | Fecal Coliform (col/ml) | FC:FS |
|---|---|---|---|---|---|---|---|
| H1 | Turkey Creek at SR 327 | 0.023 | **0.07** | 43% | 7 | 130 | 2 |
| H2 | Mud Creek at SR 327 | 0.055 | **0.11** | **50%** | **18** | **6250** | **9** |
| H3 | Mud Creek between Henry and Big Turkey Lakes | 0.020 | **0.12** | 17% | 6 | 80 | 0.3 |
| H3 | Mud Creek between Henry and Big Turkey Lakes (STORM) | NA | **0.25** | NA | **150** | NA | NA |
| H4 | Cochran Ditch at CR 350S | 0.016 | **0.11** | 15% | **23** | **600** | 2 |
| H4 | Cochran Ditch at CR 350S (STORM) | NA | **0.17** | NA | **107** | NA | NA |
| H5 | Turkey Creek at CR 350S | 0.012 | 0.03 | 40% | 5 | 190 | 2 |
| H6 | Turkey Creek at CR 475S | 0.027 | **0.04** | **68%** | 8 | **280** | 3 |
| H6 | Turkey Creek at CR 475S (STORM) | NA | **0.17** | NA | **123** | NA | NA |

OP=Orthophosphorus
TP=Total Phosphorus
% Ortho=OP/TP*100
TSS=Total Suspended Solids
FC:FS=Ratio of Fecal Coliform to Fecal Streptococcus
NA=Sample Not Available

Although samples taken during storm events are not available for all the sites, both total suspended solids and total phosphorus concentrations were elevated according to available data (H3, H4, and H6). Total phosphorus concentrations in the streams exceeded the 0.03 mg/l concentration known to induce eutrophication (overproductivity) in receiving waterbodies, and composite samples of the water columns in both Big and Little Turkey Lakes also exceeded the 0.03 mg/l level. Additionally, at Sites H2 and H6, the percentage of total phosphorus that was in a dissolved and bioavailable form was $\geq$50%.

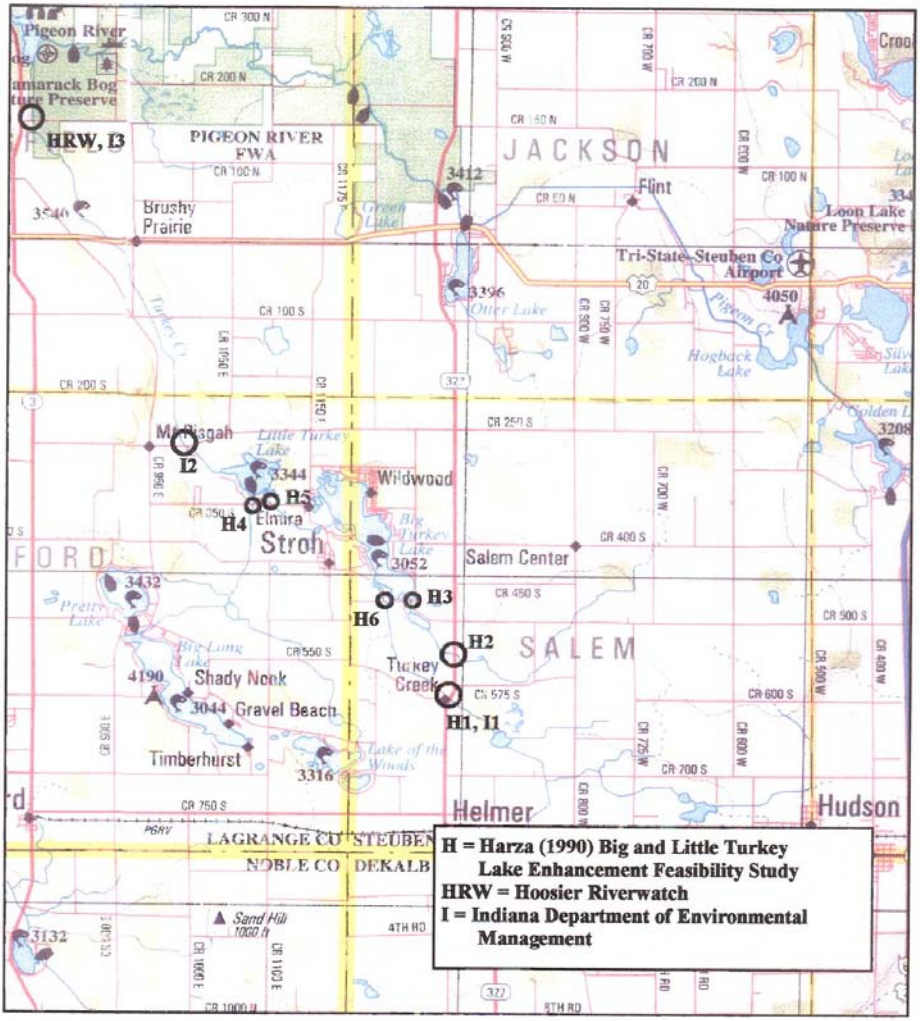


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**FIGURE 3. Historical Study Locations Map**
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Fecal coliform concentration, an indicator of mammalian waste contamination, was elevated above the Indiana state standard of 235 col/100 ml for contact recreation at Sites H2, H4, and H6 during the feasibility study sampling. According to the American Public Health Association (APHA), FC:FS>4.1 indicates pollution derived from human excrement, while FC:FS <0.7 indicates waste contamination from other sources like livestock, pets, or wildlife (APHA et al., 1985). The feasibility study notes that the FC:FS ratio of 9 measured at Site H2 suggests human sources of sewage pollution. Fecal coliform bacteria was also analyzed in Turkey Creek downstream of Little Turkey Lake by the Lakeland Middle School ecology class through the Hoosier Riverwatch Program in July of 2000 (Figure 3; Site HRW). The sample exceeded the Indiana state standard by almost 400 col/100 ml.

The Big and Little Turkey Lake Enhancement Feasibility Study (Harza Engineering Company, 1990) concluded that Mud Creek contributed water to the lakes that was poorer in quality than any other stream in the sampled during the study. The study cites high acreages of highly erodible land and low acreages of existing wetland as possible causes for the poor quality of water leaving its subbasin.

**Macroinvertebrate Data**

Macroinvertebrates have been sampled two times at two different sites by the Lakeland Middle School Hoosier Riverwatch Program and by the IDEM Biological Studies Section. The Hoosier Riverwatch water quality index for the Turkey Creek site downstream of Little Turkey Lake (Figure 3; Site HRW) estimated stream quality to be "good" within this reach on 7/7/2000. Three high quality taxa including mayfly nymphs, caddis fly larvae, and right-handed snails were collected in the sample. However, the insect sample collected at the juncture of SR 327 and Turkey Creek by IDEM (Figure 3; Site I1) in August of 1990 placed water quality within the stream on the low end of the moderately impaired range. The site received a mIBI score of 2.2 out of a possible 8 points. (As will be explained in more detail in the Methods Section, the mIBI is a measure of biological stream health.) The pollution tolerant Chironomidae family composed >50% of the sample. Metrics based on numbers of pollution intolerant taxa received poor to very poor scores.

**Mussel Data**

No known mussel sampling has been conducted within the streams of the Turkey Creek Watershed to date. However, the IDNR Division of Fish and Wildlife collected live or freshly dead shells of some species in both Big and Little Turkey Lakes (Table 3). Because mussels occupy the benthic (bottom) zone of aquatic habitats which is particularly prone to degradation by sedimentation and other pollutants, their presence and diversity is generally related to good water quality.

**TABLE 3. Mussel species collected by the IDNR in Big and Little Turkey Lakes in 2000.**

| Scientific Name | Common Name |
|---|---|
| **Little Turkey Lake** | |
| *Lampsilis siliquoidea* | Fatmucket |
| *Pyganodon grandis* | Giant floater |
| *Utterbackia imbecillis* | Paper pondshell |

| **Big Turkey Lake** | |
|---|---|
| *Lampsilis siliquoidea* | Fatmucket |
| *Pyganodon grandis* | Giant floater |
| *Corbicula fluminea* | Asian clam |

**Stream Fish Community Data**

Although the IDNR has regularly sampled the fish communities in all of the large, public lakes in the watershed since the 1960s, very little work has been done to characterize the fish communities of streams and creeks within the watershed. The IDEM Biological Studies Section has sampled fish and calculated an Index of Biotic Integrity (IBI) for three different sites in the watershed. Karr (1981) first developed the IBI for evaluating biotic integrity of fish communities. Simon (1997) further modified and calibrated the IBI for use in the Northern Indiana Till Plain Ecoregion of Indiana. Biological integrity is defined as, "the ability of a aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the best natural habitats within a region" (Karr and Dudley, 1981).

The IBI is designed to assess biotic integrity directly through twelve attributes of fish communities in streams. These attributes fall into such categories as species richness and composition, trophic composition, and fish abundance, and condition. After data from sampling sites have been collected, values for the twelve metrics are compared with their corresponding expected values (Simon, 1997) and a rating of 1, 3, or 5 is assigned to each metric based on whether it deviates strongly from, somewhat from, or closely approximates the expected values. The sum of these ratings gives a total IBI score for the site. The best possible IBI score is 60 (Table 4).

**TABLE 4. Attributes of Index of Biotic Integrity classification.**

| IBI | Integrity Class | Attributes |
|---|---|---|
| 58-60 | Excellent | Comparable to the best situation without human disturbance. |
| 48-52 | Good | Species richness somewhat below expectations. |
| 40-44 | Fair | Signs of additional deterioration include loss of intolerant forms. |
| 28-34 | Poor | Dominated by omnivores, tolerant forms, and habitat generalists. |
| 12-22 | Very Poor | Few fish present. Mostly introduced or tolerant forms. |
| 0 | No Fish | Repeat sampling finds no fish. |

Source: Development of Index of Biotic Integrity Expectations for the Ecoregions of Indiana III. Northern Indiana Till Plain (Simon, 1997).

In 1991, the IDEM Biological Studies Section conducted three fish community surveys on Turkey Creek (Sites I1, I2, and I3; Figure 3). A total of 149 fish representing 20 species and 7 families were collected (Table 5). Bluntnose minnow (Pimephales notatus) dominated the catch at 32% of the total. Bluegill (Lepomis macrochirus), rock bass (Ambloblites rupenstris), and johnny darter (Etheostoma nigrum), were also important components of the community at 9%, 9%, and 6% respectively. The minnow family (Cyprinidae) comprised 40% of the total sample followed by the sunfish family (Centrarchidae) with 32%. Of the 149 fish collected, 68 (46%)

were highly tolerant while 18 (12%) were highly intolerant (sensitive). No state or federally listed endangered species were collected during the survey.

**TABLE 5. Trophic guild, tolerance, lithophile, and pioneer status of members of the Turkey Creek Watershed fish community.**

| Common Name | Site | Trophic Guild | Tolerance | Lithophilic | Pioneer |
|---|---|---|---|---|---|
| Blackside darter | I3 | insectivore | moderately tolerant | yes | no |
| Bluegill | I1,2 | insectivore | moderately tolerant | no | no |
| Bluntnose minnow | I1,3 | omnivore | highly tolerant | no | yes |
| Central mudminnow | I2 | omnivore | highly tolerant | no | no |
| Common carp | I1,3 | omnivore | highly tolerant | no | no |
| Golden shiner | I1 | insectivore | highly tolerant | no | no |
| Grass pickerel | I2 | piscivore | moderately tolerant | no | no |
| Green sunfish | I2,3 | insectivore | highly tolerant | no | yes |
| Hornyhead chub | I2 | insectivore | intolerant | no | no |
| Johnny darter | I1,2 | insectivore | intermediate | no | yes |
| Largemouth bass | I1,2,3 | carnivore | moderately tolerant | no | no |
| Mottled sculpin | I2 | insectivore | intermediate | no | no |
| Northern hog sucker | I2,3 | insectivore | intolerant | yes | no |
| Orangethroat darter | I2 | insectivore | moderately tolerant | yes | yes |
| Pumpkinseed | I1,2,3 | insectivore | moderately tolerant | no | no |
| Rock bass | I2,3 | carnivore | moderately intolerant | no | no |
| Striped shiner | I1,3 | insectivore | moderately tolerant | yes | no |
| Warmouth | I2 | carnivore | moderately tolerant | no | no |
| White sucker | I1,2,3 | omnivore | highly tolerant | yes | no |
| Yellow bullhead | I1,2,3 | insectivore | moderately tolerant | no | no |

Source: Development of Index of Biotic Integrity Expectations for the Ecoregions of Indiana III. Northern Indiana Till Plain (Simon, 1997).

IBI scores were calculated based on data collected by IDEM and are included in Table 6. IBI values ranged from a high of 32 (poor) at Site I3 to a low of 26 (poor-very poor) at Site I2. Site I1 scored a 28 (poor). No scores fell between 40 (fair) and 60 (excellent) or below 22 (very poor-no fish). These results indicate that overall stream fish communities within Turkey Creek were of poor quality in 1991. Poor quality fish communities are typically dominated by omnivores, tolerant forms, and habitat generalists. Usually few top predators exist, and growth rates and condition factors are depressed (Simon, 1997).

**TABLE 6. IBI score and integrity class by site on Turkey Creek.**

| Site (Location) | IBI | Integrity Class |
|---|---|---|
| I1 (S.R. 327 Bridge) | 28 | Poor |
| I2 (C.R. 275 S Bridge) | 26 | Poor-Very Poor |
| I3 (C.R. 150 N Bridge) | 32 | Poor |

The lack of darter/madtom/sculpin (DMS) species, low percent of headwater species, small proportion of sensitive species, low numbers of lithophilic individuals, and low catch per unit

effort (CPUE) negatively affected the IBI score (28) at Site I1. Lack of DMS species and simple lithophilic individuals indicates that clean gravel or cobble substrates were lacking. (Lithophilic individuals are those requiring gravel or other small pebble surfaces for successful spawning.) Sensitive species typically comprise 5-10% of common species sampled in Indiana (Simon, 1997). No sensitive species were collected at Site I1 suggestive of water quality conditions not suitable for pollution intolerant forms. Because presence of headwater species indicates that stable habitat and low environmental stress exist in the stream, the lack of these individuals at Site I1 is a reflection of an unstable system.

A fish community similar to that at Site I1 was also sampled at Site I2 in 1991. Lack of darter, sensitive, and lithophilic individuals and a low CPUE resulted in the poor-very poor IBI score of 26. Anthropogenic disturbances can interfere with the food chain in aquatic systems resulting in the absence of top predators from the fish community. However, at Site I2 the number of sunfish and percent carnivore IBI metrics received strong scores indicating that the food chain remained intact. Because the food chain appeared healthy, habitat and water quality were evidently not conducive to growth and reproduction of less tolerant organisms.

Site I3 lies just downstream of the Turkey Creek Watershed just prior to Turkey Creek's confluence with the Pigeon River. Though not technically in the watershed, fish community health downstream is related to Turkey Creek Watershed health and the quality of water exported from the area. The IBI score of 32 places Turkey Creek in the poor integrity class. Although the fish community was fairly diverse (16 species were collected), the CPUE was low, suggesting anthropogenic disturbance, poor habitat, and/or degraded water quality.

**Natural Communities and Endangered, Threatened, and Rare Species**

The Indiana Natural Heritage Data Center database provides information on the presence of endangered, threatened, or rare species, high quality natural communities, and natural areas in Indiana. The database was developed to assist in documenting the presence of special species and significant natural areas and to serve as a tool for setting management priorities in areas where special species or habitats exist. The database relies on observations from individuals rather than systematic field surveys by the IDNR. Because of this, it does not document every occurrence of special species or habitat. At the same time, the listing of a species or natural area does not guarantee that the listed species is present or that the listed habitat is in pristine condition. To assist users, the database includes the date that the species or special habitat was last observed and reported in a specific location.

According to the database search, the Turkey Creek Watershed supports the state-significant wetland/fen community type. The state-rare grove meadow grass (*Poa alsodes*) was documented in the area in 1929, and the American badger (*Taxidea taxus*), a state endangered species was listed in 1994. Lake of the Woods and McClish Lake are listed in the database as fostering populations of the native fish cisco (*Coregonus artedi*). The database lists the species as of "special concern" in Indiana.

Ciscos are thought to be the only salmonid native to inland waters of Indiana (Pearson, 2001). Due to cool temperature (68°F) and minimum dissolved oxygen (3 mg/l) requirements, in Indiana the species is living at the southern-most edge of its natural geographic range (Frey,

1955). Eutrophication, which results in the destruction of the "cisco layer" (a layer where oxygen-containing waters are not too warm for cisco survival), has led to the extirpation of cisco from many northern Indiana lakes (Pearson, 2001; IDNR, personal communication).

According to an IDNR report on cisco population status in the state, Big Long Lake, Lake of the Woods, and McClish Lake have fostered populations of cisco (Pearson, 2001). Table 7 taken from the IDNR report (Pearson, 2001) gives population status of ciscos in these three lakes since 1955. Big Long Lake and Lake of the Woods both contained cisco in the recent past; however, the species is believed to be extirpated from the two lakes now. McClish Lake is the only lake within the study area that has been found to still support the species. It is not certain if Big Turkey, Little Turkey, or Pretty Lake ever supported cisco populations (IDNR, personal communication).

**TABLE 7. Population status of ciscos in Turkey Creek Watershed lakes since 1955. The data was taken directly from Pearson, 2001.**

| Lake | County | 1955 | 1975 | 1994 | 2000 |
|---|---|---|---|---|---|
| Big Long | LaGrange | R | E | E | E |
| Lake of the Woods | Steuben/LaGrange | C | C | E | E |
| McClish | Steuben/LaGrange | C | C | C | C |

C=common
R=rare
E=extirpated

## METHODS

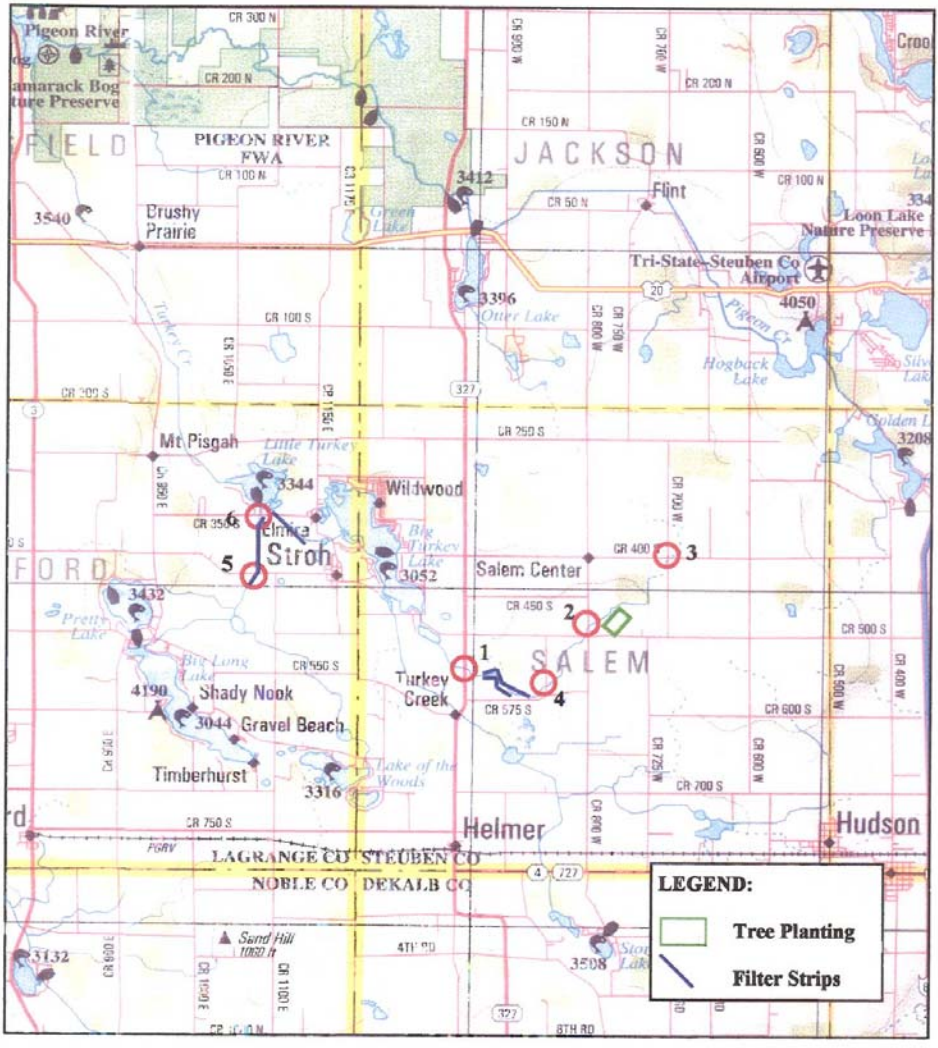
### Sampling Timing and Locations

Water quality, macroinvertebrates, and habitat quality were sampled on June 19 and November 2, 2001. The sampling times were targeted at collection of filter/scraper-type organisms in the spring and shredder-type organisms in the fall. The fall sampling was later than is desirable; however, base flow conditions at least one week prior to collection are required for an unbiased sample, and base flow during the month of October never occurred. (Due to rain events throughout the October, sampling trips were cancelled four times.) Six sampling locations (Table 8 and Figure 4) were chosen with the help of Kent Tracy and Kelly Bushong of the Steuben County Soil and Water Conservation District (SWCD). Table 8 contains descriptions of the sampling locations including their UTM zone 16 NAD 1983 coordinates. Sampling locations were chosen as upstream and downstream of planned watershed land treatment projects (Figure 4). Photos of the sites appear in Appendix A.

**TABLE 8. Detailed sampling location information for the Turkey Creek Watershed.**

| Site # | Stream Name | Road Location | Place Sampled | UTM Zone 16 NAD 1983 Coordinates |
|---|---|---|---|---|
| 1 | Mud Creek | intersection with SR 327 | upstream of bridge | 652,730.89 x 4,603,009.89 |
| 2 | Mud Creek | intersection with CR 800 W | upstream of road crossing | 655,113.52 x 4,603,966.41 |
| 3 | Mud Creek | intersection with CR 400 S | downstream of road crossing | 656,632.22 x 4,605,399.47 |
| 4 | Mud Creek | intersection with CR 850 W | downstream of road crossing | 654,329.20 x 4,602,702.01 |
| 5 | Cochran Ditch | intersection with CR 425 S | downstream of bridge | 648,469.84 x 4,604,824.42 |
| 6 | Cochran Ditch | Intersection with CR 350 S | downstream of bridge | 648,519.90 x 4,606,047.82 |

It is important to note that all the sampling locations are on streams that are designated as legal drains. Legal drains are important for water conductance to sustain a variety of land uses, including agriculture. Even though none of the study streams is currently scheduled for maintenance, disturbance to the system is inevitable due to periodic drainage improvement projects. In fact, according to the Steuben County Surveyor's Office, Mud Creek was cleaned (dredged) between Site 1 on SR 327 and Site 4 on CR 850W in 2000. Currently, there are no plans to excavate or dredge Cochran Ditch; however, periodically beavers are removed from the area, the sediment trap located on the upstream (south) side of the CR 350S bridge is dredged, and brush along the ditch bank is sprayed with herbicide (Rex Pranger, Lagrange County Surveyor, personal communication). Additionally, projects constructed within the drainage easement require County Drainage Board permission. Projects may not be permitted if they impede drainage.




Scale: 1" = 1.87 Miles

**FIGURE 4. Monitoring Sampling Locations and Planned Project Sites Monitoring Study for the Turkey Creek Watershed Land Treatment Project Area Steuben County SWCD LaGrange and Steuben Counties, Indiana**

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**Water Quality Sampling Methods**

Water quality measurements including pH, conductivity, temperature, and dissolved oxygen were measured prior to each collection in June and October. Conductivity was measured using an Orion Quikcheck Model 118 and pH using an Orion Quikcheck Model 106. Temperature and dissolved oxygen were measured using a YSI Model 5500 meter. A brief description of the various parameters follows:

**pH** The pH of stream water describes the concentration of acidic ions (specifically $H^+$) present in the water. The pH also determines the form, solubility, and toxicity of a wide range of other aqueous compounds. The Indiana Administrative Code (327 IAC 2-1) establishes a range of 6-9 pH units for the protection of aquatic life.

**Conductivity** Conductivity is a measure of the ability of an aqueous solution to carry an electric current. This ability depends on the presence of ions: on their total concentration, mobility, and valence (APHA, 1995). During low discharge, conductivity is higher than during storm water runoff because the water moves more slowly across or through ion-containing soils and substrates during base flow. Carbonates and other charged particles dissolve into the slow-moving water, thereby increasing conductivity measurements.

**Temperature** The IAC (327 IAC 2-1-6) sets maximum temperature limits for Indiana streams. Temperatures during the month of May should not exceed 80°F (23.7°C) by more than 3°F (1.7°C). June temperatures should not exceed 90°F (32.2°C). The Code also states that "the maximum temperature rise at any time or place...shall not exceed 5°F (2.8°C) in streams...". Temperature can determine the form, solubility, and toxicity of a broad range of aqueous compounds.

**Dissolved Oxygen (D.O.)** D.O. is the dissolved gaseous form of oxygen. It is essential for respiration of fish and other aquatic organisms. Fish need at least 3-5 parts per million (ppm) of D.O. Coldwater fish such as trout generally require higher concentrations of D.O. than warmwater fish such as bass or bluegill. The IAC sets minimum D.O. concentrations at 6 mg/l for coldwater fish. D.O. enters water by diffusion from the atmosphere and as a byproduct of photosynthesis by algae and plants. Excessive algae growth can over-saturate (greater than 100% saturation) the water with D.O., a condition known as supersaturation. Waterbodies overloaded with algae and macrophytes often exhibit supersaturation due to high levels of photosynthesis. Rapid photosynthetic rates produce even more plant material, and low dissolved oxygen conditions can result when the plants die and bacteria consume oxygen to decompose the material. Bacterial decomposition completes the positive feedback loop by mineralizing or releasing nutrients resulting in plant growth and production. Dissolved oxygen is consumed by respiration of aquatic organisms, such as fish, and during bacterial decomposition of plant and animal matter.

**Macroinvertebrate Sampling Methods**

Macroinvertebrate samples from each of the six sites were used to calculate an index of biotic integrity using methods established by the Environmental Protection Agency (EPA) and IDEM (Barbour et al., 1999 and IDEM, 1996). Aquatic macroinvertebrates are important indicators of environmental change. The insect community composition reflects water quality, and research

shows that different macroinvertebrate orders and families react differently to pollution sources. Indices of biotic integrity are valuable because aquatic biota integrate cumulative effects of sediment and nutrient pollution (Ohio EPA, 1999).

Macroinvertebrates were collected during base flow conditions on June 19 and November 2, 2001 using the multihabitat approach detailed in the USEPA Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, 2nd edition (Barbour et al., 1999). Kick nets were utilized to sample available habitat types. Greater than 100 organisms were obtained from each site and preserved in 70-80% alcohol. Kick nets were carefully examined and rinsed for any remaining organisms prior to leaving the site.

In the laboratory the sample was evenly spread into a pan of 1,925 $cm^2$ in discreet 5 cm x 5 cm quadrats numbered 1-77 (IDEM, 1996). Organisms in random squares were counted and sorted. Sorting continued until all organisms had been removed from the last quadrat necessary to obtain 100 organisms. Sorted organisms were identified to the family level, and IDEM datasheets were completed for each sampling event (Appendix B). The family-level approach was used: 1) to collect data comparable to that collected by IDEM in the state; 2) because it allows for increased organism identification accuracy; 3) because several studies support the adequacy of family-level analysis (Furse et al. 1984, Ferraro and Cole 1995, Marchant 1995, Bowman and Bailey 1997, Waite et al. 2000).

Macroinvertebrate data were used to calculate the Family-level Hilsenhoff Biotic Index (FBI). Calculation of the FBI involves applying assigned macroinvertebrate family tolerance values to all taxa present that have an assigned FBI tolerance value, multiplying the number of organisms present by their family tolerance value, summing the products, and dividing by the total number of organisms present (Hilsenhoff, 1988). Organisms of greater tolerance to organic pollution were assigned a greater value on a scale from 1 to 9; therefore, a higher value on the FBI scale indicates greater impairment (levels or organic pollution).

In addition to the FBI, macroinvertebrate results were analyzed using the IDEM mIBI (IDEM, 1996). mIBI scores allow comparison with data compiled by IDEM for wadeable riffle-pool streams in Indiana. Table 9 lists the ten scoring metrics with classification scores of 0-8. The mean of the ten metrics is the mIBI score. mIBI scores of 0-2 indicate the sampling site is severely impaired; scores of 2-4 indicate the site is moderately impaired, scores of 4-6 indicate the site is slightly impaired, and scores of 6-8 indicate that the site is not impaired. IDEM developed the classification criteria based on five years of wadeable riffle-pool data collected in Indiana. The data were lognormally distributed for each of the ten metrics. Each of the ten metric's lognormal distribution was then pentasected with scoring based on five categories using 1.5 times the interquartile range around the geometric mean. All ten of the metrics were used for the mIBI calculation in this study: family-level FBI, number of taxa, number of individuals, percent dominant taxa, EPT Index, EPT count, EPT count to total number of individuals, EPT count to chironomid count, chironomid count, and total number of individuals to number of square sorted. (EPT stands for individuals of the Ephemeroptera, Plecoptera, and Trichoptera Orders. Organisms belonging to these orders are generally pollution intolerant and indicative of good water quality conditions.)

**TABLE 9. Benthic macroinvertebrate scoring metrics and classification scores used by IDEM in evaluation of riffle-pool streams in Indiana.**

| | SCORING CRITERIA FOR THE FAMILY LEVEL MACROINVERTEBRATE INDEX OF BIOTIC INTEGRITY (mIBI) USING PENTASECTION AND CENTRAL TENDENCY ON THE LOGARITHMIC TRANSFORMED DATA DISTRIBUTIONS OF THE 1990-1995 RIFFLE KICK SAMPLES | | | | |
|---|---|---|---|---|---|
| | | CLASSIFICATION SCORE | | | |
| | 0 | 2 | 4 | 6 | 8 |
| Family Level FBI | ≥5.63 | 5.62- 5.06 | 5.05-4.55 | 4.54-4.09 | ≤4.08 |
| Number of Taxa | ≤7 | 8-10 | 11-14 | 15-17 | ≥18 |
| Number of Individuals | ≤79 | 129-80 | 212-130 | 349-213 | ≥350 |
| Percent Dominant Taxa | ≥61.6 | 61.5-43.9 | 43.8-31.2 | 31.1-22.2 | ≤ 22.1 |
| EPT Index | ≤2 | 3 | 4-5 | 6-7 | ≥8 |
| EPT Count | ≤19 | 20-42 | 43-91 | 92-194 | ≥195 |
| EPT Count To Total Number of Individuals | ≤0.13 | 0.14-0.29 | 0.30-0.46 | 0.47-0.68 | ≥0.69 |
| EPT Count To Chironomid Count | ≤0.88 | 0.89-2.55 | 2.56-5.70 | 5.71-11.65 | ≥11.66 |
| Chironomid Count | ≥147 | 146-55 | 54-20 | 19-7 | ≤6 |
| Total Number of Individuals To Number of Squares Sorted | ≤29 | 30-71 | 72-171 | 172-409 | ≥410 |

Where 0-2 = Severely Impaired; 2-4 = Moderately Impaired; 4-6 = Slightly Impaired; 6-8 = Nonimpaired

## Habitat Sampling Methods

During the spring sampling, physical habitat was evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989, 1995). The QHEI focuses on general habitat characteristics known to be important to

successful fish survival and reproduction. Various attributes of the habitat are scored based on the overall importance of each to the maintenance of viable, diverse, and functional aquatic faunas. The type(s) and quality of substrates, amount and quality of in-stream cover, channel morphology, extent and quality of riparian vegetation, pool, run, and riffle development and quality, and gradient are some of the metrics used to determine the QHEI score. Scores typically range from 20 to 100.

The QHEI is used to evaluate the characteristics of a stream segment, as opposed to the characteristics of a single sampling site. As such, individual sites may have poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of stream segments in Ohio have indicated that values greater than 60 are *generally* conducive to the existence of warmwater faunas. Scores greater than 75 typify habitat conditions that have the ability to support exceptional warmwater faunas (Ohio EPA, 1999).

## RESULTS

### Water Quality

Table 10 contains the results of the Mud Creek and Cochran Ditch water quality sampling efforts in the spring and fall of 2001. During both sampling periods, pH measurements were more basic than acidic and were within the Indiana state standard range of 6-9 units that is considered suitable for aquatic life. Conductivity levels were normal for base flow discharge. Temperatures in June and November were below maximum limits set by Indiana standards (32.2°C). Dissolved oxygen levels were also suitable for aquatic life with all measurements well above the Indiana state standard range of 3-5 ppm. These levels can support warm water fish communities and the intolerant macroinvertebrate communities indicative of good water quality.

**TABLE 10. Water quality data sampled in Mud Creek and Cochran Ditch in the spring and fall of 2001.**

| Date | Site | pH | Cond. (µmhos) | Temp. (°C) | Dissolved Oxygen (mg/l) |
|---|---|---|---|---|---|
| 19Jun01 | Mud Creek at SR 327 (Site 1) | 8.3 | 600 | 22 | 10.2 |
| 02Nov01 | Mud Creek at SR 327 (Site 1 | 7.5 | 600 | 12.8 | 9.8 |
| 19Jun01 | Mud Creek at CR 800 W (Site 2) | 7.9 | 600 | 21 | 8.5 |
| 02Nov01 | Mud Creek at CR 800 W (Site 2) | 7.5 | 600 | 13 | 9.3 |
| 19Jun01 | Mud Creek at CR 400 S (Site 3) | 7.4 | 700 | 21 | 9.0 |
| 02Nov01 | Mud Creek at CR 400 S (Site 3) | 7.3 | 800 | 13 | 8.2 |
| 19Jun01 | Mud Creek at CR 850 W (Site 4) | 7.9 | 500 | 22.5 | 9.0 |
| 02Nov01 | Mud Creek at CR 850 W (Site 4) | 7.5 | 700 | 12.8 | 10.8 |
| 19Jun01 | Cochran Ditch at CR 425 S (Site 5) | 8.1 | 500 | 27 | 9.2 |
| 02Nov01 | Cochran Ditch at CR 425 S (Site 5) | 7.7 | 500 | 13 | 11.1 |
| 19Jun01 | Cochran Ditch at CR 350 S (Site 6) | 7.9 | 400 | 28 | 7.8 |
| 02Nov01 | Cochran Ditch at CR 350 S (Site 6) | 7.6 | 500 | 13 | 10.4 |

### Macroinvertebrates

mIBI scores for each sampling site are given in Tables 11 (June) and 12 (October). Detailed mIBI results and bench sheets are included in Appendix B. The mIBI scores ranged from 1.4 to 3.0. June scores for two of the sites indicate severe impairment, while the remaining four sites were classified as moderately impaired. Scores calculated for the November collection resulted in poorer ratings for Sites 2, 3, and 6, while scores for the remaining sites either increased slightly (Site 4) or remained the same (Sites 1 and 5).

**TABLE 11. Classification scores and mIBI score for sampling sites in Mud Creek and Cochran Ditch as sampled in the spring of 2001 (19Jun01).**

| | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 |
|---|---|---|---|---|---|---|
| FBI | 2 | 4 | 2 | 6 | 0 | 0 |
| Number of Taxa (families) | 2 | 4 | 2 | 2 | 0 | 4 |
| Number of Individuals | 2 | 2 | 2 | 2 | 2 | 2 |
| % Dominant Taxa | 4 | 4 | 2 | 2 | 4 | 8 |
| EPT Index | 2 | 4 | 4 | 2 | 4 | 4 |
| EPT Count | 0 | 0 | 2 | 2 | 0 | 2 |
| EPT Count/Total Count | 0 | 2 | 4 | 2 | 0 | 2 |
| EPT Count/Chironomid Count | 0 | 2 | 4 | 4 | 0 | 2 |
| Chironomid Count | 4 | 6 | 6 | 6 | 6 | 4 |
| Total Count/Number Squares Sorted | 0 | 0 | 0 | 0 | 0 | 0 |
| **mIBI Score** | **1.6** | **2.8** | **2.8** | **2.8** | **1.6** | **2.8** |

**TABLE 12. Classification scores and mIBI score for sampling sites in Mud Creek and Cochran Ditch as sampled in fall of 2001 (02Nov01).**

| | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 |
|---|---|---|---|---|---|---|
| FBI | 0 | 6 | 2 | 2 | 0 | 0 |
| Number of Taxa (families) | 0 | 0 | 0 | 4 | 2 | 4 |
| Number of Individuals | 2 | 2 | 2 | 2 | 2 | 2 |
| % Dominant Taxa | 6 | 2 | 2 | 4 | 0 | 0 |
| EPT Index | 0 | 0 | 0 | 4 | 4 | 6 |
| EPT Count | 0 | 0 | 0 | 0 | 0 | 0 |
| EPT Count/Total Count | 0 | 0 | 0 | 0 | 0 | 0 |
| EPT Count/Chironomid Count | 0 | 0 | 0 | 6 | 0 | 4 |
| Chironomid Count | 8 | 8 | 8 | 8 | 8 | 8 |
| Total Count/Number Squares Sorted | 0 | 0 | 0 | 0 | 0 | 0 |
| **mIBI Score** | **1.6** | **1.8** | **1.4** | **3.0** | **1.6** | **2.4** |

Table 13 presents the families collected during the spring and fall sampling events and their corresponding tolerance values. In general, organisms collected during both events have been assigned high tolerance values (larger numbers), and more tolerant individuals were collected than intolerant. The low number of individuals and low total number of individuals to number of squares sorted metrics lowered the mIBI scores. Additionally, relatively small numbers of individuals belonging to the Ephemeroptera, Plecoptera, and Trichoptera orders were collected. Organisms belonging to these three orders are typically pollution intolerant and indicate conditions of higher quality.

**TABLE 13. Macroinvertebrate families collected during the spring and fall sampling events and their corresponding tolerance values (IDEM, 1996). The smaller the value, the less pollution-tolerant the family is. NS indicates that the family has not been scored in available literature.**

| Spring | |
|---|---|
| **Family** | **Tolerance Value** |
| Gammaridae | 4 |
| Perlodidae | 2 |
| Simulidae | 6 |
| Chironomidae | 6 |
| Hydropsychidae | 1 |
| Leptoceridae | 4 |
| Planorbidae | NS |
| Sphaeriidae | 8 |
| Hydrobiidae | 8 |
| Physidae | 8 |
| Hydrophilidae | NS |
| Valvatidae | NS |
| Calopterygidae | 5 |
| Baetidae | 4 |
| Elmidae | 4 |
| Cordulidae | 3 |
| Hydroptilidae | 4 |
| Erpobdellidae | NS |
| Perlidae | 1 |
| Amphipoda | NS |
| Heptageniidae | 4 |
| Caenidae | 7 |
| Talitridae | 8 |
| Brachycentridae | 1 |

| Fall | |
|---|---|
| **Family** | **Tolerance Value** |
| Gammaridae | 4 |
| Planorbidae | NS |
| Valvatidae | NS |
| Lymnaeidae | 6 |
| Hydrobiidae | 8 |
| Physidae | 8 |
| Sphaeriidae | 8 |
| Elmidae | 4 |
| Oligochaeta | NS |
| Chironomidae | 6 |
| Hydrophilidae | NS |
| Hydropsychidae | 4 |
| Perlodidae | NS |
| Ephydridae | 6 |
| Tabanidae | 6 |
| Talitridae | 8 |
| Chironomidae (blood red) | 8 |
| Haliplidae | NS |
| Coenagrionidae | 9 |
| Baetidae | 4 |
| Notonectidae | NS |
| Heptageniidae | 4 |
| Caenidae | 7 |
| Polycentropodidae | 6 |
| Sialdae | 4 |

**Habitat**

QHEI scores are listed in Table 14 for each of the six sampling sites. (The QHEI was scored during the spring sampling only.) QHEI datasheets may be found in Appendix C. Sites 1 and 5 scored the lowest at 43, while Site 4 scored the highest at 65.75. All QHEI scores except that scored at Site 4 were lower than the minimum score of 60 found by the Ohio EPA to be conducive to aquatic life support in Ohio streams. In general, a lack of or very poor pool-riffle-run development lowered QHEI scores for reaches within the Turkey Creek Watershed.

**TABLE 14. QHEI scores for sampling sites on Mud Creek and Cochran Ditch as sampled in spring of 2001 (19Jun01).**

| Site | Substrate Score | Cover Score | Channel Score | Riparian Score | Pool Score | Riffle Score | Gradient Score | Total Score |
|---|---|---|---|---|---|---|---|---|
| Maximum Possible Score | 20 | 20 | 20 | 10 | 12 | 8 | 10 | **100** |
| Site 1 | 13 | 9 | 7 | 6 | 0 | 0 | 8 | **43** |
| Site 2 | 15 | 9 | 10 | 5.5 | 0 | 4 | 10 | **53.5** |
| Site 3 | 16 | 14 | 10 | 5.5 | 0 | 5 | 8 | **58.5** |
| Site 4 | 16 | 10 | 14 | 7.75 | 5 | 3 | 10 | **65.75** |
| Site 5 | 7 | 15 | 6 | 7 | 0 | 0 | 8 | **43** |
| Site 6 | 16 | 10 | 7 | 5 | 0 | 0 | 8 | **46** |

## DISCUSSION

### Water Quality, Macroinvertebrate, and Habitat Data

While the general water quality parameter values measured during this study were conducive to aquatic life, macroinvertebrate and habitat analysis indicated impairment. (It is important to note here that many chemical contaminants that may affect aquatic life in the streams were not measured during this study.) Macroinvertebrate communities were dominated by tolerant forms (Table 13). Delong and Brusven (1998) suggest that agricultural non-point source pollution resulted in a relatively homogeneous assemblage of insects capable of tolerating agricultural alteration. Far fewer organisms were collected per sample and per sampling grid than would be expected from a more healthy community (Tables 11 and 12 and Appendix B).

The relative impairment of Mud Creek and Cochran Ditch may be placed into context by comparing three of the mIBI metrics to data collected in Otter Creek in Vigo County, Indiana. Otter Creek has been suggested as a reference stream because it appears to have good water quality, contains a high quality fish and mussel fauna, and is in close proximity to people living in Terre Haute (Wente, 1995). Table 15 displays the results of the comparison. Three of the macroinvertebrate metrics calculated during this study for Mud Creek and Cochran Ditch are generally poor in comparison to the average of samples collected in Otter Creek in 1991 and 1994. Numbers of individuals belonging to the EPT orders are significantly lower in the two streams in the Turkey Creek Watershed. Even though Mud Creek contains relatively few families belonging to the EPT orders, chironomid numbers are also low giving the stream a better EPT/chironomid metric than either Cochran Ditch or Otter Creek. The FBI indices of both Mud Creek and Cochran Ditch are higher (poorer) than that of Otter Creek.

**TABLE 15. Comparison of three mIBI metrics for Mud Creek, Cochran Ditch, and Otter Creek. Otter Creek was sampled by Wente of Lake Hart Research (Wente, 1995) as part of another LARE study in 1994 and by IDEM in 1991. Numbers represent averages of all available data.**

| Waterbody | EPT | EPT/Chiromonid | FBI |
|---|---|---|---|
| Mud Creek | 1.72 | 2.08 | 5.13 |
| Cochran Ditch | 0.60 | 1.43 | 7.68 |
| Otter Creek | 40.72 | 1.58 | 4.72 |

June and November data was similar for most sites; however, scores calculated for Sites 2 and 3 dropped significantly from June to November by one and 1.4 points respectively. Although the exact reason from the decrease cannot be known with certainty, two possible reasons exist. First, the two sites are located in fairly small streams that are poorly buffered from agriculture in the immediate watershed. The immediate areas adjacent to Sites 2 and 3 had recently experienced disturbance due to crop harvest. Between the June and November site visits, an increase in sediment deposition was visible at Site 3. The stream at the other four sites was either ponded and flowing slowly due to proximity to Little Turkey Lake (Sites 5 and 6) or was buffered from agricultural areas by larger zones (Sites 1 and 4). Secondly, due to relative lack of riparian buffer zones around Sites 2 and 3, the large rain events of October may have disproportionately affected the insect communities at the two locations. Because riparian buffer zones and filter strips encourage water infiltration, they slow and decrease water delivery to stream channels.

They also offer water filtration capabilities that can improve water quality in runoff. The lack of such zones in the vicinity of Sites 2 and 3 may have allowed runoff from the strong rainfall events of October to disproportionately and adversely affect the macroinvertebrate communities living there. Additionally, non-existent or limited riparian zones decrease the amount of organic material reaching the stream. Food limitation may have negatively impacted shredder-type macroinvertebrates and interfered with the streams' food web.

Although poor water quality cannot be dismissed as a causative factor, Karr (1995) lists several other common causes of resource degradation: 1) altered supply of organic material for food and habitat from the riparian corridor; 2) sedimentation of substrate spaces causing a loss of habitat; 3) lack of coarse woody debris; 4) destruction of riparian vegetation and natural bank structure; 5) lack of deep pool areas; 6) altered abundance and distribution of pool-riffle-run complexes; 7) altered flow regime. These factors can also affect a stream's ability to support a healthy biological community including insects, shellfish, other invertebrates, amphibians, and fish.

Based on the habitat data, it is likely that Turkey Creek Watershed streams also suffer from many of the factors listed by Karr. Collectively, all six stream reaches received the lowest percentage of possible QHEI points in the pool, riffle, and channel morphology categories. Pool development was not noted for any reach except at Site 4. Riffles were only present at three of the six sites and were poorly developed at those sites. Channel morphology scores indicate that the streams suffer from low sinuosity, low stability, and other modifications like canopy removal and bank shaping.

**Macroinvertebrate and Habitat Correlation Analysis**

Biological and habitat indices were analyzed for relationships that could provide additional insight into mechanisms governing impairment within the watershed. The mIBI and the QHEI scores were found to be statistically correlated for the spring sampling event (Figure 5). All of the data taken together (Figure 6) also showed this same relationship. As one would expect, sites with better general habitat fostered healthier macroinvertebrate communities. The reaches that obtained better habitat scores fostered less tolerant insect communities. Fewer pollution-tolerant chironomids were collected and the ratio of EPT counts to chironomid counts was lower in these reaches. Among all the habitat variables evaluated by the QHEI, the channel, pool, and gradient metrics explained significant portions of the variance in mIBI score for the ditches in the Turkey Creek Watershed. Most notably, Site 4 obtained the highest QHEI and spring and fall mIBI scores. It is also interesting to note that Site 1 on Mud Creek "represented the poorest water quality" during the feasibility study of 1990 (Harza Engineering Company, 1990) and received one of the lowest mIBI scores during this study both for the spring and fall samplings.

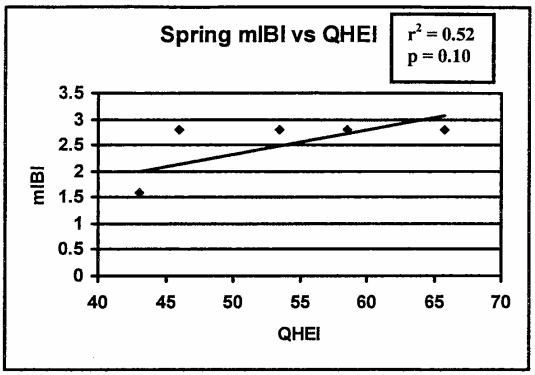


**FIGURE 5. Statistically significant relationship between QHEI score and mIBI score during the spring sampling event.**

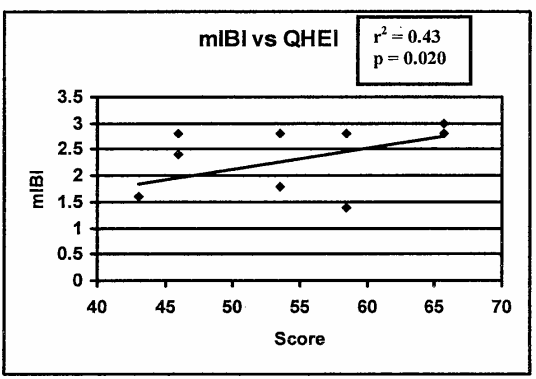


**FIGURE 6. Statistically significant relationship between QHEI score and mIBI score for all collected data.**

## SUMMARY AND RECOMMENDATIONS

In summary, although the chemical water quality parameters evaluated during this study were conducive to aquatic life support, assessment of the benthic macroinvertebrate community itself indicated impairment. In fact, according to Indiana Department of Environmental Management (IDEM) 305(b) report assessment criteria (IDEM, 2000), Mud Creek and Cochran Ditch are probably incapable at this time of supporting a "well-balanced, warm water aquatic community" (Indiana Administrative Code 2-1-3). Habitat quality (as scored using the QHEI) was also degraded and heavily influenced by agricultural drainage and maintenance activities. In fact, two of the three stream habitat characteristics found to be the most impaired (channel structure and pool presence) were also the most influential in explaining macroinvertebrate community integrity.

Due to the limited scope of this study, only general recommendations can be proposed at this time. These prioritizations are simply guidelines based on conditions documented during this study. These conditions may change as land use or other watershed-level factors change.

1. Implement planned Best Management Practices (BMPs) in locations throughout the watershed. Coordinate these projects with the county drainage boards to ensure that the project meets the goals of both the Soil and Water Conservation District (SWCD) and the drainage board. For example, a SWCD planting project in an area that is scheduled for drainage project de-brushing will not result in the optimum use of resources. Coordination projects with the drainage boards should include protection of existing vegetated areas along ditch banks and regular sediment basin maintenance.
2. Continue the monitoring program as BMPs are installed in the watershed. Post-construction monitoring will be necessary in order to determine if watershed treatment is having a measurable impact on the stream biota.
3. Extend management to the watershed-level. Although streamside localized BMPs are important, research conducted in Wisconsin shows that the biotic community mostly responds to large-scale watershed influences rather than local riparian land use changes (Weigel et al., 2000). Examples of working at the watershed-level include coordinating with producers to implement nutrient, pesticide, tillage, and coordinated resource management plans. Large-scale reductions in agricultural non-point source pollution are necessary for stream health improvement (Osmond and Gale, 1995).
4. Provide information about streams within the Turkey Creek Watershed to local landowners. Landowners will be more likely to conserve and protect the creeks if they understand their value. The outreach program could include pointers on how landowners themselves can help protect the waterways.

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# APPENDIX A

## SITE PHOTOS

**TURKEY CREEK WATERSHED LAND TREATMENT PROJECT AREA**

**STEUBEN COUNTY, INDIANA**

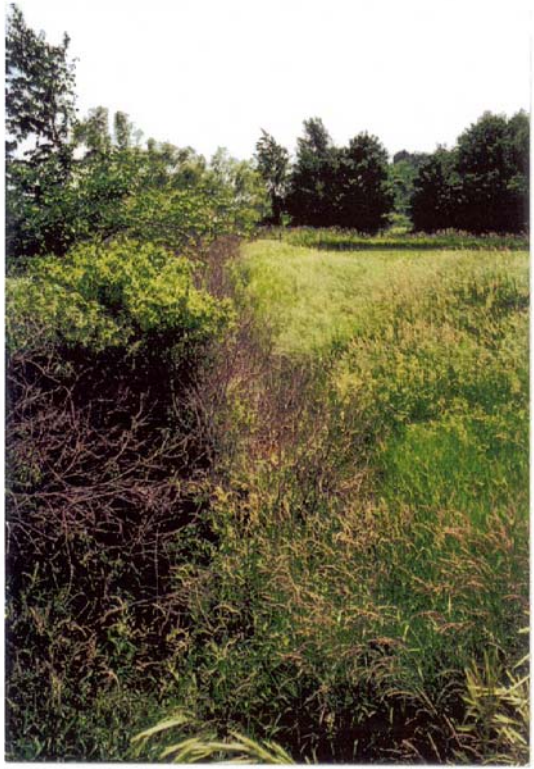
Mud Creek at SR 327 (Site 1) during the spring sampling event.

Mud Creek at CR 800 W (Site 2) during the spring sampling event.

**APPENDIX A.** **Site Photos**
**Monitoring Study for the Turkey Creek Watershed Land Treatment Project Area**
**Steuben County SWCD**
**LaGrange and Steuben Counties, Indiana**

JFNA# 00-09-17

J.F. New & Associates
wetland consultants environmental engineers



Mud Creek at CR 400 S (Site 3) during the spring sampling event.

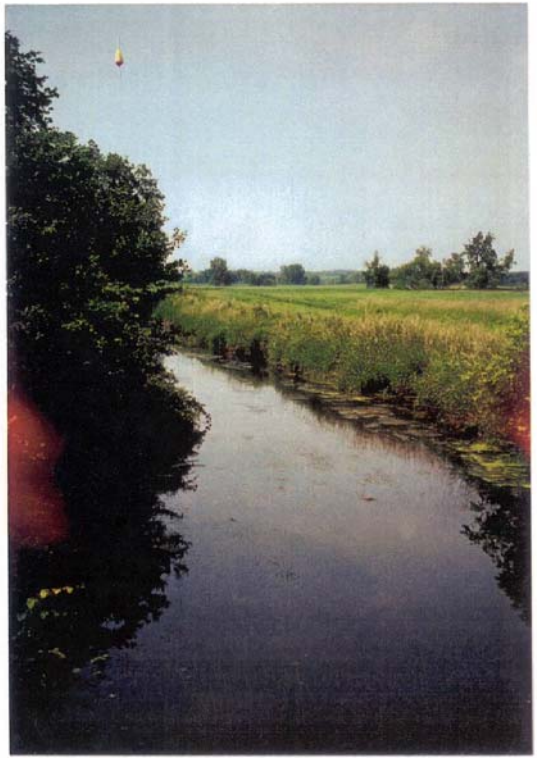
Mud Creek at CR 850 W (Site 4) during the spring sampling event.

**APPENDIX A.** **Site Photos**
**Monitoring Study for the Turkey Creek Watershed Land Treatment Project Area**
**Steuben County SWCD**
**LaGrange and Steuben Counties, Indiana**

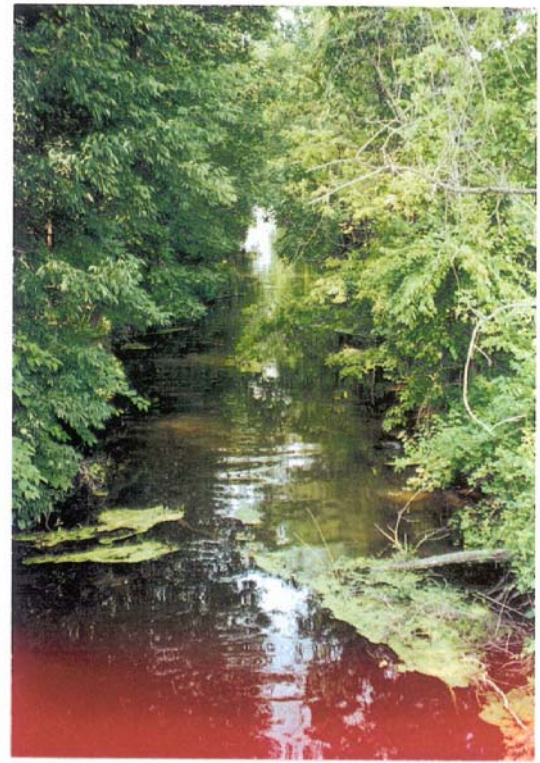
JFNA# 00-09-17

J.F. New & Associates

wetland consultants / environmental engineers



**Cochran Ditch at CR 425 S (Site 5) during the spring sampling event.**



**Cochran Ditch at CR 350 S (Site 6) during the spring sampling event.**

**APPENDIX A.** **Site Photos**
**Monitoring Study for the Turkey Creek**
**Watershed Land Treatment Project Area**
**Steuben County SWCD**
**LaGrange and Steuben Counties, Indiana**

JFNA# 00-09-17

J.F. New & Associates
wetland consultants · environmental engineers

# APPENDIX B

## DETAILED mIBI RESULTS AND BENCH SHEETS

TURKEY CREEK WATERSHED LAND TREATMENT PROJECT AREA

STEUBEN COUNTY, INDIANA

**TABLE B1. Mud Creek at SR 327 (Site 1) spring mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 5.31 | 2 |
| Number of Taxa (families) | 10 | 2 |
| Number of Individuals | 100 | 2 |
| % Dominant Taxa | 36.9 | 4 |
| EPT Index | 3.6 | 2 |
| EPT Count | 5 | 0 |
| EPT Count/Total Count | 0.05 | 0 |
| EPT Count/Chironomid Count | 0.23 | 0 |
| Chironomid Count | 22 | 4 |
| Total Count/Number Squares Sorted | 14.7 | 0 |
| **mIBI Score** | | **1.6** |

**TABLE B2. Mud Creek at CR 800 W (Site 2) spring mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 4.61 | 4 |
| Number of Taxa (families) | 12 | 4 |
| Number of Individuals | 103 | 2 |
| % Dominant Taxa | 41 | 4 |
| EPT Index | 4.29 | 4 |
| EPT Count | 15 | 0 |
| EPT Count/Total Count | 0.15 | 2 |
| EPT Count/Chironomid Count | 1.15 | 2 |
| Chironomid Count | 13 | 6 |
| Total Count/Number Squares Sorted | 9.4 | 0 |
| **mIBI Score** | | **2.8** |

**TABLE B3. Mud Creek at CR 400 S (Site 3) spring mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 5.31 | 2 |
| Number of Taxa (families) | 9 | 2 |
| Number of Individuals | 119 | 2 |
| % Dominant Taxa | 56.3 | 2 |
| EPT Index | 4 | 4 |
| EPT Count | 36 | 2 |
| EPT Count/Total Count | 0.3 | 4 |
| EPT Count/Chironomid Count | 3.6 | 4 |
| Chironomid Count | 10 | 6 |
| Total Count/Number Squares Sorted | 23.8 | 0 |
| **mIBI Score** | | **2.8** |

**TABLE B4. Mud Creek at CR 850 W (Site 4) spring mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 4.30 | 6 |
| Number of Taxa (families) | 10 | 2 |
| Number of Individuals | 125 | 2 |
| % Dominant Taxa | 52.4 | 2 |
| EPT Index | 3.88 | 2 |
| EPT Count | 24 | 2 |
| EPT Count/Total Count | 0.19 | 2 |
| EPT Count/Chironomid Count | 2.67 | 4 |
| Chironomid Count | 9 | 6 |
| Total Count/Number Squares Sorted | 20.80 | 0 |
| **mIBI Score** | | **2.8** |

**TABLE B5. Cochran Ditch at CR 425 S (Site 5) spring mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 6.76 | 0 |
| Number of Taxa (families) | 7 | 0 |
| Number of Individuals | 104 | 2 |
| % Dominant Taxa | 33.7 | 4 |
| EPT Index | 4 | 4 |
| EPT Count | 1 | 0 |
| EPT Count/Total Count | 0.01 | 0 |
| EPT Count/Chironomid Count | 0.07 | 0 |
| Chironomid Count | 14 | 6 |
| Total Count/Number Squares Sorted | 4.95 | 0 |
| **mIBI Score** | | **1.6** |

**TABLE B6. Cochran Ditch at CR 350 S (Site 6) spring mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 6.37 | 0 |
| Number of Taxa (families) | 11 | 4 |
| Number of Individuals | 108 | 2 |
| % Dominant Taxa | 19.4 | 8 |
| EPT Index | 4.93 | 4 |
| EPT Count | 29 | 2 |
| EPT Count/Total Count | 0.27 | 2 |
| EPT Count/Chironomid Count | 1.38 | 2 |
| Chironomid Count | 21 | 4 |
| Total Count/Number Squares Sorted | 5.1 | 0 |
| **mIBI Score** | | **2.8** |

**TABLE B7. Mud Creek at SR 327 (Site 1) fall mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 6.68 | 0 |
| Number of Taxa (families) | 7 | 0 |
| Number of Individuals | 106 | 2 |
| % Dominant Taxa | 27 | 6 |
| EPT Index | 0 | 0 |
| EPT Count | 0 | 0 |
| EPT Count/Total Count | 0 | 0 |
| EPT Count/Chironomid Count | 0 | 0 |
| Chironomid Count | 0 | 8 |
| Total Count/Number Squares Sorted | 9.6 | 0 |
| **mIBI Score** | | **1.6** |

**TABLE B8. Mud Creek at CR 800 W (Site 2) fall mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 4.43 | 6 |
| Number of Taxa (families) | 5 | 0 |
| Number of Individuals | 100 | 2 |
| % Dominant Taxa | 58 | 2 |
| EPT Index | 0 | 0 |
| EPT Count | 0 | 0 |
| EPT Count/Total Count | 0 | 0 |
| EPT Count/Chironomid Count | 0 | 0 |
| Chironomid Count | 4 | 8 |
| Total Count/Number Squares Sorted | 4 | 0 |
| **mIBI Score** | | **1.8** |

**TABLE B9. Mud Creek at CR 400 S (Site 3) fall mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 5.14 | 2 |
| Number of Taxa (families) | 6 | 0 |
| Number of Individuals | 107 | 2 |
| % Dominant Taxa | 52 | 2 |
| EPT Index | 0 | 0 |
| EPT Count | 0 | 0 |
| EPT Count/Total Count | 0 | 0 |
| EPT Count/Chironomid Count | 0 | 0 |
| Chironomid Count | 0 | 8 |
| Total Count/Number Squares Sorted | 4.28 | 0 |
| **mIBI Score** | | **1.4** |

**TABLE B10. Mud Creek at CR 850 W (Site 4) fall mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 5.23 | 2 |
| Number of Taxa (families) | 14 | 4 |
| Number of Individuals | 100 | 2 |
| % Dominant Taxa | 34 | 4 |
| EPT Index | 3.56 | 4 |
| EPT Count | 9 | 0 |
| EPT Count/Total Count | 0.09 | 0 |
| EPT Count/Chironomid Count | 9 | 0 |
| Chironomid Count | 1 | 8 |
| Total Count/Number Squares Sorted | 5.56 | 0 |
| **mIBI Score** | | **3.0** |

**TABLE B11. Cochran Ditch at CR 425 S (Site 5) fall mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 7.65 | 0 |
| Number of Taxa (families) | 12 | 4 |
| Number of Individuals | 102 | 2 |
| % Dominant Taxa | 73 | 0 |
| EPT Index | 5.75 | 6 |
| EPT Count | 8 | 0 |
| EPT Count/Total Count | 0.08 | 0 |
| EPT Count/Chironomid Count | 4 | 4 |
| Chironomid Count | 2 | 8 |
| Total Count/Number Squares Sorted | 6.38 | 0 |
| **mIBI Score** | | **2.4** |

**TABLE B12. Cochran Ditch at CR 350 S (Site 6) fall mIBI metrics.**

| | | Metric Score |
|---|---|---|
| HBI | 7.95 | 0 |
| Number of Taxa (families) | 8 | 2 |
| Number of Individuals | 106 | 2 |
| % Dominant Taxa | 89 | 0 |
| EPT Index | 4 | 4 |
| EPT Count | 1 | 0 |
| EPT Count/Total Count | 0.9 | 0 |
| EPT Count/Chironomid Count | 0.25 | 0 |
| Chironomid Count | 4 | 8 |
| Total Count/Number Squares Sorted | 11.8 | 0 |
| **mIBI Score** | | **1.6** |

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 1 SITE: Mud Creek at SR 327 COUNTY: Steuben CREW CHIEF:
LOCATION: upstream of bridge HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19 Jun 01
ECOREGION: IASNRI: SORTER: CS, SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) ____
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

**ODONATA** **ZYGOPTERA**
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

**PLECOPTERA**
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) 1 CHLOROPERLIDAE (1) ____

**HEMIPTERA**
MACROVELIIDAE ( ) ____ VELIIDAE ( ) ____ GERRIDAE ( ) ____ BELOSTOMATIDAE ( ) ____ NEPIDAE ( ) ____ CORIXIDAE ( ) ____
NOTONECTIDAE ( ) ____ PLEIDAE ( ) ____ SALDIDAE ( ) ____ HEBRIDAE ( ) ____ NAUCORIDAE ( ) ____ MESOVELIIDAE ( ) ____

**MEGALOPTERA** SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE ( ) ____

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) 2
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) ____ PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) ____ LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) 2

**LEPIDOPTERA** PYRALIDAE (5) ____ NOCTUIDAE ( ) ____

**COLEOPTERA**
GYRINIDAE( ) ____ HALIPLIDAE( ) ____ DYTISCIDAE( ) ____ HYDROPHILIDAE( ) 2 PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) ____
SCIRTIDAE ( ) ____ STAPHYLINIDAE ( ) ____ CHRYSOMELIDAE ( ) ____ CURCULIONIDAE ( ) ____ HYDRAENIDAE ( ) ____

**DIPTERA**
BLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) ____ ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(6) ____ CHIRONOMIDAE(all other)(6) 22 SYRPHIDAE (10) ____ EPHYDRIDAE (6) ____ MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) 11 CHAOBORIDAE ( ) ____

**COLLEMBOLA** ISOTOMIDAE ( ) ____ PODURIDAE ( ) ____ SMINTHURIDAE ( ) ____ ENTOMOBRYIDAE ( ) ____

**OTHER ARTHROPODA**
ACARI (4) ____ ASELLIDAE (8) ____ GAMMARIDAE (4) 38 TALITRIDAE (8) ____ ASTACIDAE (6) ____

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) ____ AMNICOLA (8) 9 PLEUROCERIDAE ( ) ____ VIVIPARIDAE ( ) ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) 1 PLANORBIDAE ( ) 12 HYDROBIIDAE ( ) ____ ANCYLIDAE ( ) ____
**PELECYPODA** SPHAERIIDAE (8) ____ CORBICULA ( ) ____ DREISSENIA ( ) ____

**PLATYHELMINTHES** TURBELLARIA (4) ____ ANNELIDA ( ) ____ OLIGOCHAETA ( ) ____ TUBIFICIDAE ( ) ____ NAIDIDAE ( ) ____
HIRUDINEA ( ) ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA ( ) ____ ERPOBDELLIDAE ( ) ____ NEMATODA ( ) ____

NUMBER OF VIALS FORWARDED: 12 PRELIMINARY NUMBER OF TAXA: 12 NUMBER OF INDIVIDUALS: 103

HBI: 5.21 EPT COUNT: 5 EPT ABUN./CHIR. ABUN.: 0.23 CHIRONOMID COUNT: 22

% DOMINANT TAXON: 36.9% EPT INDEX: 3.6 EPT/TOTAL COUNT: 0.05

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 6/26/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 1 ____ SITE: Mud Creek at COUNTY: Steuben CREW CHIEF:
LOCATION: upstream of SR 327 HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: bridge IASNRI: SORTER: SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) ____
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

**ODONATA ZYGOPTERA**
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

**PLECOPTERA**
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) ____ CHLOROPERLIDAE (1) ____

**HEMIPTERA**
MACROVELIIDAE ( ) ____ VELIIDAE ( ) ____ GERRIDAE ( ) ____ BELOSTOMATIDAE ( ) ____ NEPIDAE ( ) ____ CORIXIDAE ( ) ____
NOTONECTIDAE ( ) ____ PLEIDAE ( ) ____ SALDIDAE ( ) ____ HEBRIDAE ( ) ____ NAUCORIDAE ( ) ____ MESOVELIIDAE ( ) ____

**MEGALOPTERA** SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE ( ) ____

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) ____
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) ____ PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) ____ LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) ____

**LEPIDOPTERA** PYRALIDAE (5) ____ NOCTUIDAE ( ) ____

**COLEOPTERA**
GYRINIDAE( ) ____ HALIPLIDAE( ) ____ DYTISCIDAE( ) ____ HYDROPHILIDAE( ) ____ PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) ____
SCIRTIDAE ( ) ____ STAPHYLINIDAE ( ) ____ CHRYSOMELIDAE ( ) ____ CURCULIONIDAE ( ) ____ HYDRAENIDAE ( ) ____

**DIPTERA**
BLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) ____ ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(8) ____ CHIRONOMIDAE(all other)(6) ____ SYRPHIDAE (10) ____ EPHYDRIDAE (6) ____ MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) ____ CHAOBORIDAE ( ) ____

**COLLEMBOLA** ISOTOMIDAE ( ) ____ PODURIDAE ( ) ____ SMINTHURIDAE ( ) ____ ENTOMOBRYIDAE ( ) ____

**OTHER ARTHROPODA**
ACARI (4) ____ ASELLIDAE (8) ____ GAMMARIDAE (4) 18 TALITRIDAE (8) ____ ASTACIDAE (6) ____

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) 3 AMNICOLA (8) 29 PLEUROCERIDAE ( ) ____ VIVIPARIDAE ( ) ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) 2 PLANORBIDAE ( ) 24 HYDROBIIDAE ( ) ____ ANCYLIDAE ( ) ____
**PELECYPODA** SPHAERIIDAE (8) 7 CORBICULA ( ) ____ DREISSENIA ( ) ____

**PLATYHELMINTHES** TURBELLARIA (4) ____ ANNELIDA ( ) ____ OLIGOCHAETA ( ) ____ TUBIFICIDAE ( ) ____ NAIDIDAE ( ) ____
HIRUDINEA ( ) ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA ( ) ____ ERPOBDELLIDAE ( ) ____ NEMATODA ( ) ____

NUMBER OF VIALS FORWARDED: 7 PRELIMINARY NUMBER OF TAXA: 7 NUMBER OF INDIVIDUALS: 106

HBI: 6.68 EPT COUNT: 0 EPT ABUN./CHIR. ABUN.: 0 CHIRONOMID COUNT: 0

% DOMINANT TAXON: 27 EPT INDEX: 0 EPT/TOTAL COUNT: 0

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/5/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 2 ___ SITE: Mud Creek at 800 W COUNTY: Steuben CREW CHIEF:
LOCATION: upstream of road crossing HYDROLOGIC UNIT: 04050001-110 DATE OF COLLECTION: 19 Jun 01
ECOREGION: IASNRI: SORTER: CS, SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) 3 BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

**ODONATA ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) 1 LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

**PLECOPTERA**
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

**HEMIPTERA**
MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) ___ PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

**MEGALOPTERA** SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) 1
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) 11

**LEPIDOPTERA** PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

**COLEOPTERA**
GYRINIDAE( ) ___ HALIPLIDAE( ) ___ DYTISCIDAE( ) ___ HYDROPHILIDAE( ) ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 13
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

**DIPTERA**
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) ___ CHIRONOMIDAE(all other)(6) 13 SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) 15 CHAOBORIDAE ( ) ___

**COLLEMBOLA** ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

**OTHER ARTHROPODA**
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) 42 TALITRIDAE (8) ___ ASTACIDAE (6) ___

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ___ HELISOMA (6) 1 LYMNAEA (6) ___ AMNICOLA (8) ___ PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE ( ) 1 HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___
**PELECYPODA** SPHAERIIDAE (8) 1 CORBICULA ( ) ___ DREISSENIA ( ) ___

**PLATYHELMINTHES** TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) ___ TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) ___ NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 12 PRELIMINARY NUMBER OF TAXA: 12 NUMBER OF INDIVIDUALS: 103

HBI: 4.61 EPT COUNT: 15 EPT ABUN./CHIR. ABUN.: 1.15 CHIRONOMID COUNT: 13

% DOMINANT TAXON: 41% EPT INDEX: 4.29 EPT/TOTAL COUNT: 0.15

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 2 Jul 01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 2 ___ SITE: Mud Creek at COUNTY: Steuben CREW CHIEF:
LOCATION: upstream of road crossing CR 800 W. HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: IASWRI: SORTER: SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) ___ BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

**ODONATA ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

**PLECOPTERA**
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

**HEMIPTERA**
MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) ___ PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

**MEGALOPTERA** SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) ___
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) ___

**LEPIDOPTERA** PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

**COLEOPTERA**
GYRINIDAE( ) ___ HALIPLIDAE( ) ___ DYTISCIDAE( ) ___ HYDROPHILIDAE( ) ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 14
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

**DIPTERA**
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) ___ CHIRONOMIDAE(all other)(6) 4 SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) ___ CHAOBORIDAE ( ) ___

**COLLEMBOLA** ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

**OTHER ARTHROPODA**
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) 58 TALITRIDAE (8) ___ ASTACIDAE (6) ___

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) ___ AMNICOLA (8) ___ PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE ( ) ___ HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___
**PELECYPODA** SPHAERIIDAE (8) 7 CORBICULA ( ) ___ DREISSENIA ( ) ___

**PLATYHELMINTHES** TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) 17 TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) ___ NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 5 PRELIMINARY NUMBER OF TAXA: 5 NUMBER OF INDIVIDUALS: 100

HBI: 4.43 EPT COUNT: 0 EPT ABUN./CHIR. ABUN.: 0 CHIRONOMID COUNT: 4

% DOMINANT TAXON: 58 EPT INDEX: 0 EPT/TOTAL COUNT: 0

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/5/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 3 ___ SITE: Mud Creek at 400S COUNTY: Steuben CREW CHIEF:
LOCATION: downstream of road HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19Jun01
ECOREGION: crossing IASNRI: SORTER: CS, SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) ___ BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

**ODONATA** **ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

**PLECOPTERA**
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

**HEMIPTERA**
MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) ___ PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

**MEGALOPTERA** SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) 33
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) 1 PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) 2

**LEPIDOPTERA** PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

**COLEOPTERA**
GYRINIDAE( ) ___ HALIPLIDAE( ) ___ DYTISCIDAE( ) ___ HYDROPHILIDAE( ) 1 PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 1
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

**DIPTERA**
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) ___ CHIRONOMIDAE(all other)(6) 10 SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) 67 CHAOBORIDAE ( ) ___

**COLLEMBOLA** ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

**OTHER ARTHROPODA**
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) 3 TALITRIDAE (8) ___ ASTACIDAE (6) ___

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) ___ AMNICOLA (8) ___ PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (6) ___ PLANORBIDAE ( ) ___ HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___
**PELECYPODA** SPHAERIIDAE (8) ___ CORBICULA ( ) ___ DREISSENIA ( ) ___

**PLATYHELMINTHES** TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) ___ TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) 1 NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 8 PRELIMINARY NUMBER OF TAXA: 9 NUMBER OF INDIVIDUALS: 119

HBI: 5.31 EPT COUNT: 36 EPT ABUN./CHIR. ABUN.: 3.6 CHIRONOMID COUNT: 10

% DOMINANT TAXON: 56.3% EPT INDEX: 4 EPT/TOTAL COUNT: 0.30

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 7/2/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 3 ___ SITE: Mud Creek at COUNTY: Steuben CREW CHIEF:
LOCATION: downstream CR 400S. HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: of road crossing IASNRI: SORTER: SZ LABEL CHECK: ✓

**EPHEMEROPTERA**

SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) ___ BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

**ODONATA ZYGOPTERA**

CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

**PLECOPTERA**

PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

**HEMIPTERA**

MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) ___ PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

**MEGALOPTERA** SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

**TRICHOPTERA**

PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) ___
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) ___

**LEPIDOPTERA** PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

**COLEOPTERA**

GYRINIDAE( ) ___ HALIPLIDAE( ) ___ DYTISCIDAE( ) ___ HYDROPHILIDAE( ) 1 PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 13
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

**DIPTERA**

BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) ___ CHIRONOMIDAE(all other)(6) ___ SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) ___ CHAOBORIDAE ( ) ___

**COLLEMBOLA** ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

**OTHER ARTHROPODA**

ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) 17 TALITRIDAE (8) ___ ASTACIDAE (6) ___

**MOLLUSCA**

**GASTROPODA** FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) ___ AMNICOLA (8) ___ PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE ( ) 12 HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___

**PELECYPODA** SPHAERIIDAE (8) 12 CORBICULA ( ) ___ DREISSENIA ( ) ___

**PLATYHELMINTHES** TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) 52 TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) ___ NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 6 PRELIMINARY NUMBER OF TAXA: 6 NUMBER OF INDIVIDUALS: 107

HBI: 5.14 EPT COUNT: 0 EPT ABUN./CHIR. ABUN.: 0 CHIRONOMID COUNT: 0

% DOMINANT TAXON: 52% EPT INDEX: 0 EPT/TOTAL COUNT: 0

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/5/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 4 ___ SITE: Mud Creek at 850 W COUNTY: Steuben CREW CHIEF:
LOCATION: downstream of road crossing HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19 Jun 2001
ECOREGION: ___ IASNRI: ___ SORTER: CS, SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) 7 BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

**ODONATA ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

**PLECOPTERA**
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) 1 PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

**HEMIPTERA**
MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) ___ PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

**MEGALOPTERA** SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) 15
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) 1

**LEPIDOPTERA** PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

**COLEOPTERA**
GYRINIDAE( ) ___ HALIPLIDAE( ) ___ DYTISCIDAE( ) ___ HYDROPHILIDAE( ) ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 15
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

**DIPTERA**
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(6) ___ CHIRONOMIDAE(all other)(6) 9 SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) 9 CHAOBORIDAE ( ) ___

**COLLEMBOLA** ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

**OTHER ARTHROPODA**
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) 65 TALITRIDAE (8) ___ ASTACIDAE (6) ___

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) ___ AMNICOLA (8) ___ PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE ( ) 2 HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___
**PELECYPODA** SPHAERIIDAE (8) 1 CORBICULA ( ) ___ DRIESSENIA ( ) ___

**PLATYHELMINTHES** TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) ___ TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) ___ NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 10 PRELIMINARY NUMBER OF TAXA: 10 NUMBER OF INDIVIDUALS: 125

HBI: 4.30 EPT COUNT: 24 EPT ABUN./CHIR. ABUN.: 2.67 CHIRONOMID COUNT: 9

% DOMINANT TAXON: 52% EPT INDEX: 3.88 EPT/TOTAL COUNT: 0.19

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 6/25/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 4 SITE: Mud Creek at COUNTY: Steuben CREW CHIEF:
LOCATION: downstream of road crossing CR 850 W HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: IASNRI: SORTER: SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) ____
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

**ODONATA ZYGOPTERA**
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

**PLECOPTERA**
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) 2 CHLOROPERLIDAE (1) ____

**HEMIPTERA**
MACROVELIIDAE ( ) ____ VELIIDAE ( ) ____ GERRIDAE ( ) ____ BELOSTOMATIDAE ( ) ____ NEPIDAE ( ) ____ CORIXIDAE ( ) ____
NOTONECTIDAE ( ) ____ PLEIDAE ( ) ____ SALDIDAE ( ) ____ HEBRIDAE ( ) ____ NAUCORIDAE ( ) ____ MESOVELIIDAE ( ) ____

**MEGALOPTERA** SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE ( ) ____

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) 7
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) ____ PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) ____ LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) ____

**LEPIDOPTERA** PYRALIDAE (5) ____ NOCTUIDAE ( ) ____

**COLEOPTERA**
GYRINIDAE( ) ____ HALIPLIDAE( ) ____ DYTISCIDAE( ) ____ HYDROPHILIDAE( ) ____ PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) 14
SCIRTIDAE ( ) ____ STAPHYLINIDAE ( ) ____ CHRYSOMELIDAE ( ) ____ CURCULIONIDAE ( ) ____ HYDRAENIDAE ( ) ____

**DIPTERA**
SLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) 2 ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(8) ____ CHIRONOMIDAE(all other)(6) 1 SYRPHIDAE (10) ____ EPHYDRIDAE (6) 1 MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) ____ CHAOBORIDAE ( ) ____

**COLLEMBOLA** ISOTOMIDAE ( ) ____ PODURIDAE ( ) ____ SMINTHURIDAE ( ) ____ ENTOMOBRYIDAE ( ) ____

**OTHER ARTHROPODA**
ACARI (4) ____ ASELLIDAE (6) ____ GAMMARIDAE (4) 34 TALITRIDAE (6) ____ ASTACIDAE (6) ____

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) 2 AMNICOLA (8) 8 PLEUROCERIDAE ( ) ____ VIVIPARIDAE ( ) ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) 1 PLANORBIDAE ( ) 5 HYDROBIIDAE ( ) ____ ANCYLIDAE ( ) ____
**PELECYPODA** SPHAERIIDAE (8) ____ CORBICULA ( ) ____ DREISSENIA ( ) ____

**PLATYHELMINTHES** TURBELLARIA (4) ____ ANNELIDA ( ) ____ OLIGOCHAETA ( ) 5 TUBIFICIDAE ( ) ____ NAIDIDAE ( ) ____
HIRUDINEA ( ) ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA ( ) ____ ERPOBDELLIDAE ( ) ____ NEMATODA ( ) ____

NUMBER OF VIALS FORWARDED: 14 PRELIMINARY NUMBER OF TAXA: 14 NUMBER OF INDIVIDUALS: 100

HBI: 5.23 EPT COUNT: 9 EPT ABUN./CHIR. ABUN.: 9 CHIRONOMID COUNT: 1

% DOMINANT TAXON: 34 EPT INDEX: 3.56 EPT/TOTAL COUNT: 0.09

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/5/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 5 ___ SITE: Cochran Ditch at 425 S COUNTY: LaGrange CREW CHIEF:
LOCATION: downstream of bridge HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19Jun01
ECOREGION: IASNRI: SORTER: LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) ___ BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

**ODONATA** **ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

**PLECOPTERA**
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

**HEMIPTERA**
MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) ___ PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

**MEGALOPTERA** SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) 1
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) ___

**LEPIDOPTERA** PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

**COLEOPTERA**
GYRINIDAE( ) ___ HALIPLIDAE( ) ___ DYTISCIDAE( ) ___ HYDROPHILIDAE( ) ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 5
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

**DIPTERA**
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(6) ___ CHIRONOMIDAE(all other)(6) 14 SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) ___ CHAOBORIDAE ( ) ___

**COLLEMBOLA** ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

**OTHER ARTHROPODA**
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) ___ TALITRIDAE (8) ___ ASTACIDAE (6) ___

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) ___ AMNICOLA (8) ___ PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) 7 PLANORBIDAE ( ) 27 HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___
**PELECYPODA** SPHAERIIDAE (8) 15 CORBICULA ( ) ___ DRIESSENIA ( ) ___

**PLATYHELMINTHES** TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) ___ TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) ___ NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 7 PRELIMINARY NUMBER OF TAXA: 7 NUMBER OF INDIVIDUALS: 104

HBI: 6.76 EPT COUNT: 1 EPT ABUN./CHIR. ABUN.: 0.07 CHIRONOMID COUNT: 14

% DOMINANT TAXON: 33.7% EPT INDEX: 4 EPT/TOTAL COUNT: 0.01

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 7/2/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 5 ___ SITE: Cochran Ditch e COUNTY: LaGrange CREW CHIEF:
LOCATION: downstream of bridge CR 425S. HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: IASNRI: SORTER: SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) 1 BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

**ODONATA ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) 1

**PLECOPTERA**
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

**HEMIPTERA**
MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) ___ PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

**MEGALOPTERA** SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (5) ___ HYDROPSYCHIDAE (4) ___
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) ___

**LEPIDOPTERA** PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

**COLEOPTERA**
GYRINIDAE( ) ___ HALIPLIDAE( ) 1 DYTISCIDAE( ) ___ HYDROPHILIDAE( ) ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) ___
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

**DIPTERA**
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) 1 ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) 4 CHIRONOMIDAE(all other)(6) ___ SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) ___ CHAOBORIDAE ( ) ___

**COLLEMBOLA** ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

**OTHER ARTHROPODA**
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) ___ TALITRIDAE (8) 94 ASTACIDAE (8) ___

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) ___ AMNICOLA (6) ___ PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE ( ) ___ HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___
**PELECYPODA** SPHAERIIDAE (8) 3 CORBICULA ( ) ___ DREISSENIA ( ) ___

**PLATYHELMINTHES** TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) ___ TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) ___ NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 8 PRELIMINARY NUMBER OF TAXA: 8 NUMBER OF INDIVIDUALS: 106

HBI: 7.95 EPT COUNT: 1 EPT ABUN./CHIR. ABUN.: 0.25 CHIRONOMID COUNT: 4

% DOMINANT TAXON: 89 EPT INDEX: 4 EPT/TOTAL COUNT: 0.9

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/6/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 6 ___ SITE: Cochran Ditch at 350S COUNTY: LaGrange CREW CHIEF:
LOCATION: downstream of bridge HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19 Jun 2001
ECOREGION: IASNRI: SORTER: CS, SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) ___ BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) 7
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) 12 OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

**ODONATA** **ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

**PLECOPTERA**
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

**HEMIPTERA**
MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) ___ PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

**MEGALOPTERA** SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) 4
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) 3 LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) 3

**LEPIDOPTERA** PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

**COLEOPTERA**
GYRINIDAE( ) ___ HALIPLIDAE( ) ___ DYTISCIDAE( ) ___ HYDROPHILIDAE( ) ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 4
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

**DIPTERA**
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) ___ CHIRONOMIDAE(all other)(6) 21 SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) ___ CHAOBORIDAE ( ) ___

**COLLEMBOLA** ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

**OTHER ARTHROPODA**
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) ___ TALITRIDAE (8) 18 ASTACIDAE (6) ___

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) ___ AMNICOLA (8) 10 PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE ( ) 17 HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___
**PELECYPODA** SPHAERIIDAE (8) 8 CORBICULA ( ) ___ DREISSENIA ( ) ___

**PLATYHELMINTHES** TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) ___ TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) ___ NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 11 PRELIMINARY NUMBER OF TAXA: 11 NUMBER OF INDIVIDUALS: 108

HBI: 6.37 EPT COUNT: 29 EPT ABUN./CHIR. ABUN.: 1.38 CHIRONOMID COUNT: 21

% DOMINANT TAXON: 19.4% EPT INDEX: 4.93 EPT/TOTAL COUNT: 0.27

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 6/26/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 6 ___ SITE: Cochran Ditch @ COUNTY: LaGrange CREW CHIEF:
LOCATION: downstream of bridge CR 350S. HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: IASNRI: SORTER: SZ LABEL CHECK: ✓

**EPHEMEROPTERA**
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) ___ BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) 2
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) 2 OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

**ODONATA ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

**PLECOPTERA**
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

**HEMIPTERA**
MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) 1 PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

**MEGALOPTERA** SIALIDAE (4) 1 CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

**TRICHOPTERA**
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) 4 HYDROPSYCHIDAE (4) ___
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) ___

**LEPIDOPTERA** PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

**COLEOPTERA**
GYRINIDAE( ) ___ HALIPLIDAE( ) ___ DYTISCIDAE( ) ___ HYDROPHILIDAE( ) ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 2
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

**DIPTERA**
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) 2 CHIRONOMIDAE(all other)(6) ___ SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) ___ CHAOBORIDAE ( ) ___

**COLLEMBOLA** ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

**OTHER ARTHROPODA**
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) ___ TALITRIDAE (8) 75 ASTACIDAE (6) ___

**MOLLUSCA**
**GASTROPODA** FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) 1 AMNICOLA (8) ___ PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE ( ) ___ HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___
**PELECYPODA** SPHAERIIDAE (8) 3 CORBICULA ( ) ___ DREISSENIA ( ) ___

**PLATYHELMINTHES** TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) 2 TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) ___ NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 12 PRELIMINARY NUMBER OF TAXA: 12 NUMBER OF INDIVIDUALS: 102

HBI: 7.65 EPT COUNT: 8 EPT ABUN./CHIR. ABUN.: 4 CHIRONOMID COUNT: 2

% DOMINANT TAXON: 73 EPT INDEX: 5.75 EPT/TOTAL COUNT: 0.08

PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/6/01 COUNTS & CALCULATION CHECK: SZ CS

# APPENDIX C

## QHEI DATA SHEETS

TURKEY CREEK WATERSHED LAND
TREATMENT PROJECT AREA

STEUBEN COUNTY, INDIANA

STREAM: **Mud Creek at SR 327 (Site 1)** RIVER MILE _____ DATE: **19Jun2001** QHEI SCORE **43**

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE **13**

| TYPE | | POOL | RIFFLE | | | POOL | RIFFLE |
|---|---|---|---|---|---|---|---|
| | BLDR/SLAB(10) | | | | GRAVEL(7) | | |
| | BOULDER(9) | | | X | SAND(6) | | |
| | COBBLE(8) | | | | BEDROCK(5) | | |
| | HARDPAN(4) | | | | DETRITUS(3) | | |
| | MUCK/SILT(2) | | | | ARTIFIC(0) | | |

TOTAL NUMBER OF SUBSTRATE TYPES: >4(2) X <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

SUBSTRATE ORIGIN (all)

- LIMESTONE(1)
- RIP/RAP(0)
- X TILLS(1)
- HARDPAN(0)
- SANDSTONE(0)
- SHALE(-1)
- COAL FINES(-2)

SILT COVER (one)

- SILT-HEAVY(-2)
- SILT-MOD(-1)
- X SILT-NORM(0)
- SILT-FREE(1)

Extent of Embeddedness (check one)

- EXTENSIVE(-2)
- MODERATE(-1)
- X LOW(0)
- NONE(1)

COMMENTS: _____

2) INSTREAM COVER: COVER SCORE **9**

TYPE (Check all that apply)

- UNDERCUT BANKS(1)
- X OVERHANGING VEGETATION(1)
- SHALLOWS (IN SLOW WATER)(1)
- DEEP POOLS(2)
- ROOTWADS(1)
- BOULDERS(1)
- OXBOWS(1)
- X AQUATIC MACROPHYTES(1)
- LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)

- EXTENSIVE >75%(11)
- X MODERATE 25-75%(7)
- SPARSE 5-25%(3)
- NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE **7**

SINUOSITY

- HIGH(4)
- MODERATE(3)
- X LOW(2)
- NONE(1)

DEVELOPMENT

- EXCELLENT(7)
- GOOD(5)
- FAIR(3)
- X POOR(1)

CHANNELIZATION

- NONE(6)
- RECOVERED(4)
- X RECOVERING(3)
- RECENT OR NO RECOVERY(1)

STABILITY

- HIGH(3)
- MODERATE(2)
- X LOW(1)

MODIFICATION/OTHER

- SNAGGING
- RELOCATION
- X CANOPY REMOVAL
- DREDGING
- ONE SIDE CHANNEL MODIFICATION
- IMPOUND
- ISLAND
- LEVEED
- X BANK SHAPING

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE **6**

RIPARIAN WIDTH (per bank)

| L | R | (per bank) |
|---|---|---|
| | | WIDE >150 ft.(4) |
| | | MODERATE 30-150 ft.(3) |
| | X | NARROW 15-30 ft.(2) |
| X | | VERY NARROW 3-15 ft.(1) |
| | | NONE(0) |

EROSION/RUNOFF-FLOODPLAIN QUALITY

| L | R | (most predominant per bank) |
|---|---|---|
| | | FOREST, SWAMP(3) |
| | | OPEN PASTURE/ROW CROP(0) |
| X | | RESID.,PARK,NEW FIELD(1) |
| | | FENCED PASTURE(1) |

| L | R | (per bank) |
|---|---|---|
| | | URBAN OR INDUSTRIAL(0) |
| | X | SHRUB OR OLD FIELD(2) |
| | | CONSERV. TILLAGE(1) |
| | | MINING/CONSTRUCTION(0) |

BANK EROSION

| L | R | (per bank) |
|---|---|---|
| X | X | NONE OR LITTLE(3) |
| | | MODERATE(2) |
| | | HEAVY OR SEVERE(1) |

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE **0**

MAX.DEPTH (Check 1)

- >4 ft.(6)
- 2.4-4 ft.(4)
- 1.2-2.4 ft.(2)
- <1.2 ft.(1)
- <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)

- POOL WIDTH>RIFFLE WIDTH(2)
- POOL WIDTH=RIFFLE WIDTH(1)
- POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)

- TORRENTIAL(-1)
- FAST(1)
- MODERATE(1)
- SLOW(1)
- EDDIES(1)
- INTERSTITIAL(-1)
- INTERMITTENT(-2)

COMMENTS: _____

RIFFLE SCORE **0**

RIFFLE/RUN DEPTH

- GENERALLY >4 in. MAX.>20 in.(4)
- GENERALLY >4 in. MAX.<20 in.(3)
- GENERALLY 2-4 in.(1)
- GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE

- STABLE (e.g., Cobble,Boulder)(2)
- MOD.STABLE (e.g., Pea Gravel)(1)
- UNSTABLE (Gravel, Sand)(0)
- NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS

- EXTENSIVE(-1)
- MODERATE(0)
- LOW(1)
- NONE(2)
- NO RIFFLE(0)

COMMENTS: **reach is 100 glide; no pool-riffle-run development is evident**

6) GRADIENT (FEET/MILE): **13.5** % POOL **0** % RIFFLE **0** % RUN **0** GRADIENT SCORE **8**

STREAM: Mud Creek at CR 800 W (Site 2) RIVER MILE _____ DATE: 19Jun2001 QHEI SCORE 53.5

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE 15

| TYPE | | POOL | RIFFLE | | | POOL | RIFFLE |
|---|---|---|---|---|---|---|---|
| | BLDER/SLAB(10) | | | X | GRAVEL(7) | | |
| | BOULDER(9) | | | X | SAND(6) | | |
| | COBBLE(8) | | | | BEDROCK(5) | | |
| | HARDPAN(4) | | | | DETRITUS(3) | | X |
| | MUCK/SILT(2) | | X | | ARTIFIC(0) | | |

TOTAL NUMBER OF SUBSTRATE TYPES: [X] >4(2) [ ] <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

SUBSTRATE ORIGIN (all)
- [ ] LIMESTONE(1)
- [ ] RIP/RAP(0)
- [X] TILLS(1)
- [ ] HARDPAN(0)
- [ ] SANDSTONE(0)
- [ ] SHALE(-1)
- [ ] COAL FINES(-2)

SILT COVER (one)
- [ ] SILT-HEAVY(-2)
- [X] SILT-MOD(-1)
- [ ] SILT-NORM(0)
- [ ] SILT-FREE(1)

Extent of Embeddedness (check one)
- [ ] EXTENSIVE(-2)
- [ ] MODERATE(-1)
- [X] LOW(0)
- [ ] NONE(1)

COMMENTS: _____

2) INSTREAM COVER: COVER SCORE 9

TYPE (Check all that apply)
- [ ] UNDERCUT BANKS(1)
- [X] OVERHANGING VEGETATION(1)
- [ ] SHALLOWS (IN SLOW WATER)(1)
- [ ] DEEP POOLS(2)
- [ ] ROOTWADS(1)
- [ ] BOULDERS(1)
- [ ] OXBOWS(1)
- [X] AQUATIC MACROPHYTES(1)
- [ ] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)
- [ ] EXTENSIVE >75%(11)
- [X] MODERATE 25-75%(7)
- [ ] SPARSE 5-25%(3)
- [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE 10

SINUOSITY
- [ ] HIGH(4)
- [ ] MODERATE(3)
- [X] LOW(2)
- [ ] NONE(1)

DEVELOPMENT
- [ ] EXCELLENT(7)
- [ ] GOOD(5)
- [X] FAIR(3)
- [ ] POOR(1)

CHANNELIZATION
- [ ] NONE(6)
- [ ] RECOVERED(4)
- [X] RECOVERING(3)
- [ ] RECENT OR NO RECOVERY(1)

STABILITY
- [ ] HIGH(3)
- [X] MODERATE(2)
- [ ] LOW(1)

MODIFICATION/OTHER
- [ ] SNAGGING
- [ ] IMPOUND
- [ ] RELOCATION
- [ ] ISLAND
- [X] CANOPY REMOVAL
- [ ] LEVEED
- [ ] DREDGING
- [X] BANK SHAPING
- [ ] ONE SIDE CHANNEL MODIFICATION

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank) RIPARIAN SCORE 5.5

River Right Looking Downstream

RIPARIAN WIDTH (per bank)

| L | R | (per bank) |
|---|---|---|
| | | WIDE >150 ft.(4) |
| | | MODERATE 30-150 ft.(3) |
| X | X | NARROW 15-30 ft.(2) |
| | | VERY NARROW 3-15 ft.(1) |
| | | NONE(0) |

EROSION/RUNOFF-FLOODPLAIN QUALITY

| L | R | (most predominant per bank) |
|---|---|---|
| | | FOREST, SWAMP(3) |
| X | | OPEN PASTURE/ROW CROP(0) |
| | | RESID.,PARK,NEW FIELD(1) |
| | | FENCED PASTURE(1) |

| L | R | (per bank) |
|---|---|---|
| | | URBAN OR INDUSTRIAL(0) |
| | | SHRUB OR OLD FIELD(2) |
| | X | CONSERV. TILLAGE(1) |
| | | MINING/CONSTRUCTION(0) |

BANK EROSION

| L | R | (per bank) |
|---|---|---|
| X | X | NONE OR LITTLE(3) |
| | | MODERATE(2) |
| | | HEAVY OR SEVERE(1) |

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY NO POOL = 0 POOL SCORE 0

MAX.DEPTH (Check 1)
- [ ] >4 ft.(6)
- [ ] 2.4-4 ft.(4)
- [ ] 1.2-2.4 ft.(2)
- [ ] <1.2 ft.(1)
- [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)
- [ ] POOL WIDTH>RIFFLE WIDTH(2)
- [ ] POOL WIDTH=RIFFLE WIDTH(1)
- [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)
- [ ] TORRENTIAL(-1)
- [ ] EDDIES(1)
- [ ] FAST(1)
- [ ] INTERSTITIAL(-1)
- [ ] MODERATE(1)
- [ ] INTERMITTENT(-2)
- [ ] SLOW(1)

COMMENTS: _____

RIFFLE SCORE 4

RIFFLE/RUN DEPTH
- [ ] GENERALLY >4 in. MAX.>20 in.(4)
- [X] GENERALLY >4 in. MAX.<20 in.(3)
- [ ] GENERALLY 2-4 in.(1)
- [ ] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE
- [ ] STABLE (e.g., Cobble,Boulder)(2)
- [ ] MOD.STABLE (e.g., Pea Gravel)(1)
- [X] UNSTABLE (Gravel, Sand)(0)
- [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS
- [ ] EXTENSIVE(-1)
- [ ] NONE(2)
- [ ] MODERATE(0)
- [ ] NO RIFFLE(0)
- [X] LOW(1)

COMMENTS: reach is 15% riffle and 85% run; no pools are evident

6) GRADIENT (FEET/MILE): 15.6 % POOL 0 % RIFFLE 15% % RUN 85% GRADIENT SCORE 10

STREAM: **Mud Creek at CR 400 S (Site 3)** RIVER MILE _____ DATE: **19Jun2001** QHEI SCORE **58.5**

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE **16**

| TYPE | | POOL | RIFFLE | | | POOL | RIFFLE |
|---|---|---|---|---|---|---|---|
| | BLDER/SLAB(10) | | | X | GRAVEL(7) | | |
| | BOULDER(9) | | | | X SAND(6) | | |
| | COBBLE(8) | | | | BEDROCK(5) | | |
| | HARDPAN(4) | | | | DETRITUS(3) | | |
| | MUCK/SILT(2) | | X | | ARTIFIC(0) | | |

SUBSTRATE ORIGIN (all)

| | | | |
|---|---|---|---|
| | LIMESTONE(1) | | RIP/RAP(0) |
| X | TILLS(1) | | HARDPAN(0) |
| | SANDSTONE(0) | | |
| | SHALE(-1) | | |
| | COAL FINES(-2) | | |

SILT COVER (one)

| | | | |
|---|---|---|---|
| | SILT-HEAVY(-2) | | SILT-MOD(-1) |
| X | SILT-NORM(0) | | SILT-FREE(1) |

Extent of Embeddedness (check one)

| | | | |
|---|---|---|---|
| | EXTENSIVE(-2) | | MODERATE(-1) |
| X | LOW(0) | | NONE(1) |

TOTAL NUMBER OF SUBSTRATE TYPES: [X] >4(2) [ ] <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

COMMENTS: **the small amount of artificial substrate is a mixture of glacial stone and rip-rap**

2) INSTREAM COVER: COVER SCORE **14**

TYPE (Check all that apply)

| | | |
|---|---|---|
| UNDERCUT BANKS(1) | DEEP POOLS(2) | OXBOWS(1) |
| OVERHANGING VEGETATION(1) | ROOTWADS(1) | X AQUATIC MACROPHYTES(1) |
| SHALLOWS (IN SLOW WATER)(1) | BOULDERS(1) | X LOGS OR WOODY DEBRIS(1) |

AMOUNT (Check only one or Check 2 and AVERAGE)

| | |
|---|---|
| X | EXTENSIVE >75%(11) |
| | MODERATE 25-75%(7) |
| | SPARSE 5-25%(3) |
| | NEARLY ABSENT <5%(1) |

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE **10**

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY | MODIFICATION/OTHER | |
|---|---|---|---|---|---|
| HIGH(4) | EXCELLENT(7) | NONE(6) | HIGH(3) | X SNAGGING | IMPOUND |
| MODERATE(3) | GOOD(5) | RECOVERED(4) | X MODERATE(2) | RELOCATION | ISLAND |
| X LOW(2) | X FAIR(3) | X RECOVERING(3) | LOW(1) | X CANOPY REMOVAL | LEVEED |
| NONE(1) | POOR(1) | RECENT OR NO RECOVERY(1) | | DREDGING | X BANK SHAPING |
| | | | | ONE SIDE CHANNEL MODIFICATION | |

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE **5.5**

| RIPARIAN WIDTH (per bank) L | R | (per bank) | EROSION/RUNOFF-FLOODPLAIN QUALITY L | R | (most predominant per bank) | L | R | (per bank) | BANK EROSION L | R | (per bank) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | WIDE >150 ft.(4) | | | FOREST, SWAMP(3) | | | URBAN OR INDUSTRIAL(0) | X | X | NONE OR LITTLE(3) |
| | | MODERATE 30-150 ft.(3) | | | OPEN PASTURE/ROW CROP(0) | X | | SHRUB OR OLD FIELD(2) | | | MODERATE(2) |
| | | NARROW 15-30 ft.(2) | | | RESID.,PARK,NEW FIELD(1) | | | CONSERV. TILLAGE(1) | | | HEAVY OR SEVERE(1) |
| X | X | VERY NARROW 3-15 ft.(1) | | X | FENCED PASTURE(1) | | | MINING/CONSTRUCTION(0) | | | |
| | | NONE(0) | | | | | | | | | |

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE **0**

MAX.DEPTH (Check 1)

| | |
|---|---|
| | >4 ft.(6) |
| | 2.4-4 ft.(4) |
| | 1.2-2.4 ft.(2) |
| | <1.2 ft.(1) |
| | <0.6 ft.(Pool=0)(0) |

MORPHOLOGY (Check 1)

| | |
|---|---|
| | POOL WIDTH>RIFFLE WIDTH(2) |
| | POOL WIDTH=RIFFLE WIDTH(1) |
| | POOL WIDTH<RIFFLE WIDTH(0) |

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)

| | | | |
|---|---|---|---|
| | TORRENTIAL(-1) | | EDDIES(1) |
| | FAST(1) | | INTERSTITIAL(-1) |
| | MODERATE(1) | | INTERMITTENT(-2) |
| | SLOW(1) | | |

COMMENTS: _____

RIFFLE SCORE **5**

RIFFLE/RUN DEPTH

| | |
|---|---|
| | GENERALLY >4 in. MAX.>20 in.(4) |
| X | GENERALLY >4 in. MAX.<20 in.(3) |
| | GENERALLY 2-4 in.(1) |
| | GENERALLY <2 in.(Riffle=0)(0) |

RIFFLE/RUN SUBSTRATE

| | |
|---|---|
| | STABLE (e.g., Cobble,Boulder)(2) |
| X | MOD.STABLE (e.g., Pea Gravel)(1) |
| | UNSTABLE (Gravel, Sand)(0) |
| | NO RIFFLE(0) |

RIFFLE/RUN EMBEDDEDNESS

| | | | |
|---|---|---|---|
| | EXTENSIVE(-1) | | NONE(2) |
| | MODERATE(0) | | NO RIFFLE(0) |
| X | LOW(1) | | |

COMMENTS: **reach is about 50% riffle and 50% run; no pools are evident**

6) GRADIENT (FEET/MILE): **12.3** % POOL **0** % RIFFLE **50** % RUN **50** GRADIENT SCORE **8**

STREAM: **Mud Creek at CR 850 W (Site 4)** RIVER MILE _____ DATE: **19Jun2001** QHEI SCORE **65.8**

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE **16**

| TYPE | POOL | RIFFLE | | POOL | RIFFLE |
|---|---|---|---|---|---|
| [ ] BLDER/SLAB(10) | | | [X] GRAVEL(7) | | |
| [ ] BOULDER(9) | | | [X] SAND(6) | | |
| [ ] COBBLE(8) | X | X | [ ] BEDROCK(5) | | |
| [ ] HARDPAN(4) | | | [ ] DETRITUS(3) | | |
| [ ] MUCK/SILT(2) | X | | [ ] ARTIFIC(0) | | |

TOTAL NUMBER OF SUBSTRATE TYPES: [X] >4(2) [ ] <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

SUBSTRATE ORIGIN (all): [ ] LIMESTONE(1) [ ] RIP/RAP(0) [X] TILLS(1) [ ] HARDPAN(0) [ ] SANDSTONE(0) [ ] SHALE(-1) [ ] COAL FINES(-2)

SILT COVER (one): [ ] SILT-HEAVY(-2) [ ] SILT-MOD(-1) [X] SILT-NORM(0) [ ] SILT-FREE(1)

Extent of Embeddedness (check one): [ ] EXTENSIVE(-2) [ ] MODERATE(-1) [X] LOW(0) [ ] NONE(1)

COMMENTS: **larger stones (cobble) was present both in the riffles and pools; the stones did not appear to be artificial**

2) INSTREAM COVER: COVER SCORE **10**

TYPE (Check all that apply): [ ] UNDERCUT BANKS(1) [ ] OVERHANGING VEGETATION(1) [ ] SHALLOWS (IN SLOW WATER)(1) [ ] DEEP POOLS(2) [ ] ROOTWADS(1) [ ] BOULDERS(1) [ ] OXBOWS(1) [X] AQUATIC MACROPHYTES(1) [X] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE): [ ] EXTENSIVE >75%(11) [X] MODERATE 25-75%(7) [ ] SPARSE 5-25%(3) [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE **14**

SINUOSITY: [ ] HIGH(4) [X] MODERATE(3) [ ] LOW(2) [ ] NONE(1)

DEVELOPMENT: [ ] EXCELLENT(7) [X] GOOD(5) [ ] FAIR(3) [ ] POOR(1)

CHANNELIZATION: [ ] NONE(6) [X] RECOVERED(4) [ ] RECOVERING(3) [ ] RECENT OR NO RECOVERY(1)

STABILITY: [ ] HIGH(3) [X] MODERATE(2) [ ] LOW(1)

MODIFICATION/OTHER: [ ] SNAGGING [ ] RELOCATION [X] CANOPY REMOVAL [ ] DREDGING [ ] ONE SIDE CHANNEL MODIFICATION [ ] IMPOUND [ ] ISLAND [ ] LEVEED [X] BANK SHAPING

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE **7.75**

RIPARIAN WIDTH (per bank)

| L | R | (per bank) |
|---|---|---|
| [ ] | [X] | WIDE >150 ft.(4) |
| [X] | [ ] | MODERATE 30-150 ft.(3) |
| [ ] | [ ] | NARROW 15-30 ft.(2) |
| [ ] | [ ] | VERY NARROW 3-15 ft.(1) |
| [ ] | [ ] | NONE(0) |

EROSION/RUNOFF-FLOODPLAIN QUALITY

| L | R | (most predominant per bank) |
|---|---|---|
| [ ] | [ ] | FOREST, SWAMP(3) |
| [X] | [ ] | OPEN PASTURE/ROW CROP(0) |
| [ ] | [X] | RESID.,PARK,NEW FIELD(1) |
| [ ] | [ ] | FENCED PASTURE(1) |

| L | R | (per bank) |
|---|---|---|
| [ ] | [ ] | URBAN OR INDUSTRIAL(0) |
| [X] | [X] | SHRUB OR OLD FIELD(2) |
| [ ] | [ ] | CONSERV. TILLAGE(1) |
| [ ] | [ ] | MINING/CONSTRUCTION(0) |

BANK EROSION

| L | R | (per bank) |
|---|---|---|
| [X] | [X] | NONE OR LITTLE(3) |
| [ ] | [ ] | MODERATE(2) |
| [ ] | [ ] | HEAVY OR SEVERE(1) |

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE **5**

MAX.DEPTH (Check 1): [ ] >4 ft.(6) [ ] 2.4-4 ft.(4) [X] 1.2-2.4 ft.(2) [ ] <1.2 ft.(1) [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1): [X] POOL WIDTH>RIFFLE WIDTH(2) [ ] POOL WIDTH=RIFFLE WIDTH(1) [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply): [ ] TORRENTIAL(-1) [ ] FAST(1) [X] MODERATE(1) [ ] SLOW(1) [ ] EDDIES(1) [ ] INTERSTITIAL(-1) [ ] INTERMITTENT(-2)

COMMENTS: _____

RIFFLE SCORE **3**

RIFFLE/RUN DEPTH: [ ] GENERALLY >4 in. MAX.>20 in.(4) [ ] GENERALLY >4 in. MAX.<20 in.(3) [X] GENERALLY 2-4 in.(1) [ ] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE: [ ] STABLE (e.g., Cobble,Boulder)(2) [X] MOD.STABLE (e.g., Pea Gravel)(1) [ ] UNSTABLE (Gravel, Sand)(0) [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS: [ ] EXTENSIVE(-1) [ ] MODERATE(0) [X] LOW(1) [ ] NONE(2) [ ] NO RIFFLE(0)

COMMENTS: **reach is about 50% riffle and 50% run; no pools are evident**

6) GRADIENT (FEET/MILE): **15.6** % POOL **20** % RIFFLE **40** % RUN **40** GRADIENT SCORE **10**

STREAM: Cochran Ditch at CR 425 S (Site 5) RIVER MILE _____ DATE: 19Jun2001 QHEI SCORE 43

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE 7

| TYPE | | POOL | RIFFLE | | | POOL | RIFFLE |
|---|---|---|---|---|---|---|---|
| | BLDR/SLAB(10) | | | [X] | GRAVEL(7) | | |
| | BOULDER(9) | | | | SAND(6) | | |
| | COBBLE(8) | | | | BEDROCK(5) | | |
| | HARDPAN(4) | | | | DETRITUS(3) | | |
| [X] | MUCK/SILT(2) | | | | ARTIFIC(0) | | |

TOTAL NUMBER OF SUBSTRATE TYPES: [ ] >4(2) [X] <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

SUBSTRATE ORIGIN (all)
- [ ] LIMESTONE(1)
- [ ] RIP/RAP(0)
- [X] TILLS(1)
- [ ] HARDPAN(0)
- [ ] SANDSTONE(0)
- [ ] SHALE(-1)
- [ ] COAL FINES(-2)

SILT COVER (one)
- [X] SILT-HEAVY(-2)
- [ ] SILT-MOD(-1)
- [ ] SILT-NORM(0)
- [ ] SILT-FREE(1)

Extent of Embeddedness (check one)
- [ ] EXTENSIVE(-2)
- [X] MODERATE(-1)
- [ ] LOW(0)
- [ ] NONE(1)

COMMENTS: _____

2) INSTREAM COVER: COVER SCORE 15

TYPE (Check all that apply)
- [ ] UNDERCUT BANKS(1)
- [ ] DEEP POOLS(2)
- [ ] OXBOWS(1)
- [X] OVERHANGING VEGETATION(1)
- [X] ROOTWADS(1)
- [X] AQUATIC MACROPHYTES(1)
- [ ] SHALLOWS (IN SLOW WATER)(1)
- [ ] BOULDERS(1)
- [ ] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)
- [X] EXTENSIVE >75%(11)
- [ ] MODERATE 25-75%(7)
- [ ] SPARSE 5-25%(3)
- [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE 6

SINUOSITY
- [ ] HIGH(4)
- [ ] MODERATE(3)
- [ ] LOW(2)
- [X] NONE(1)

DEVELOPMENT
- [ ] EXCELLENT(7)
- [ ] GOOD(5)
- [ ] FAIR(3)
- [X] POOR(1)

CHANNELIZATION
- [ ] NONE(6)
- [ ] RECOVERED(4)
- [X] RECOVERING(3)
- [ ] RECENT OR NO RECOVERY(1)

STABILITY
- [ ] HIGH(3)
- [ ] MODERATE(2)
- [X] LOW(1)

MODIFICATION/OTHER
- [X] SNAGGING
- [ ] IMPOUND
- [ ] RELOCATION
- [ ] ISLAND
- [X] CANOPY REMOVAL
- [ ] LEVEED
- [ ] DREDGING
- [ ] BANK SHAPING
- [ ] ONE SIDE CHANNEL MODIFICATION

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE 7

RIPARIAN WIDTH (per bank)

| L | R | (per bank) |
|---|---|---|
| [X] | [ ] | WIDE >150 ft.(4) |
| [ ] | [ ] | MODERATE 30-150 ft.(3) |
| [ ] | [X] | NARROW 15-30 ft.(2) |
| [ ] | [ ] | VERY NARROW 3-15 ft.(1) |
| [ ] | [ ] | NONE(0) |

EROSION/RUNOFF-FLOODPLAIN QUALITY

| L | R | (most predominant per bank) |
|---|---|---|
| [X] | [ ] | FOREST, SWAMP(3) |
| [ ] | [X] | OPEN PASTURE/ROW CROP(0) |
| [ ] | [ ] | RESID.,PARK,NEW FIELD(1) |
| [ ] | [ ] | FENCED PASTURE(1) |

| L | R | (per bank) |
|---|---|---|
| [ ] | [ ] | URBAN OR INDUSTRIAL(0) |
| [ ] | [ ] | SHRUB OR OLD FIELD(2) |
| [ ] | [ ] | CONSERV. TILLAGE(1) |
| [ ] | [ ] | MINING/CONSTRUCTION(0) |

BANK EROSION

| L | R | (per bank) |
|---|---|---|
| [X] | [ ] | NONE OR LITTLE(3) |
| [ ] | [X] | MODERATE(2) |
| [ ] | [ ] | HEAVY OR SEVERE(1) |

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE 0

MAX.DEPTH (Check 1)
- [ ] >4 ft.(6)
- [ ] 2.4-4 ft.(4)
- [ ] 1.2-2.4 ft.(2)
- [ ] <1.2 ft.(1)
- [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)
- [ ] POOL WIDTH>RIFFLE WIDTH(2)
- [ ] POOL WIDTH=RIFFLE WIDTH(1)
- [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)
- [ ] TORRENTIAL(-1)
- [ ] EDDIES(1)
- [ ] FAST(1)
- [ ] INTERSTITIAL(-1)
- [ ] MODERATE(1)
- [ ] INTERMITTENT(-2)
- [ ] SLOW(1)

COMMENTS: _____

RIFFLE SCORE 0

RIFFLE/RUN DEPTH
- [ ] GENERALLY >4 in. MAX.>20 in.(4)
- [ ] GENERALLY >4 in. MAX.<20 in.(3)
- [ ] GENERALLY 2-4 in.(1)
- [ ] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE
- [ ] STABLE (e.g., Cobble,Boulder)(2)
- [ ] MOD.STABLE (e.g., Pea Gravel)(1)
- [ ] UNSTABLE (Gravel, Sand)(0)
- [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS
- [ ] EXTENSIVE(-1)
- [ ] NONE(2)
- [ ] MODERATE(0)
- [ ] NO RIFFLE(0)
- [ ] LOW(1)

COMMENTS: reach is 100 glide; no pool-riffle-run development is evident; gradient is lower; stream was just barely flowing

6) GRADIENT (FEET/MILE): 5.3 % POOL 0 % RIFFLE 0 % RUN 0 GRADIENT SCORE 8

STREAM: Cochran Ditch at CR 350 S (Site 6) RIVER MILE _____ DATE: 19Jun2001 QHEI SCORE 46

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE 16

| TYPE | POOL | RIFFLE | | POOL | RIFFLE |
|---|---|---|---|---|---|
| BLDR/SLAB(10) | | | GRAVEL(7) | | |
| BOULDER(9) | | | X SAND(6) | | |
| COBBLE(8) | | | BEDROCK(5) | | |
| HARDPAN(4) | | | DETRITUS(3) | | |
| MUCK/SILT(2) | X | | ARTIFIC(0) | X | |

TOTAL NUMBER OF SUBSTRATE TYPES: X >4(2) <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

SUBSTRATE ORIGIN (all): LIMESTONE(1) RIP/RAP(0) X TILLS(1) HARDPAN(0) SANDSTONE(0) SHALE(-1) COAL FINES(-2)

SILT COVER (one): SILT-HEAVY(-2) SILT-MOD(-1) X SILT-NORM(0) SILT-FREE(1)

Extent of Embeddedness (check one): EXTENSIVE(-2) MODERATE(-1) X LOW(0) NONE(1)

COMMENTS: _____

2) INSTREAM COVER: COVER SCORE 10

TYPE (Check all that apply): UNDERCUT BANKS(1) X OVERHANGING VEGETATION(1) SHALLOWS (IN SLOW WATER)(1) DEEP POOLS(2) ROOTWADS(1) BOULDERS(1) OXBOWS(1) X AQUATIC MACROPHYTES(1) X LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE): EXTENSIVE >75%(11) X MODERATE 25-75%(7) SPARSE 5-25%(3) NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE 7

SINUOSITY: HIGH(4) MODERATE(3) LOW(2) X NONE(1)

DEVELOPMENT: EXCELLENT(7) GOOD(5) FAIR(3) X POOR(1)

CHANNELIZATION: NONE(6) RECOVERED(4) X RECOVERING(3) RECENT OR NO RECOVERY(1)

STABILITY: HIGH(3) X MODERATE(2) LOW(1)

MODIFICATION/OTHER: SNAGGING IMPOUND RELOCATION ISLAND X CANOPY REMOVAL LEVEED DREDGING X BANK SHAPING ONE SIDE CHANNEL MODIFICATION

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE 5

RIPARIAN WIDTH (per bank)

| L | R | (per bank) |
|---|---|---|
| | | WIDE >150 ft.(4) |
| | | MODERATE 30-150 ft.(3) |
| X | X | NARROW 15-30 ft.(2) |
| | | VERY NARROW 3-15 ft.(1) |
| | | NONE(0) |

EROSION/RUNOFF-FLOODPLAIN QUALITY

| L | R | (most predominant per bank) |
|---|---|---|
| | | FOREST, SWAMP(3) |
| | | OPEN PASTURE/ROW CROP(0) |
| X | X | RESID.,PARK,NEW FIELD(1) |
| | | FENCED PASTURE(1) |

| L | R | (per bank) |
|---|---|---|
| | | URBAN OR INDUSTRIAL(0) |
| | | SHRUB OR OLD FIELD(2) |
| | | CONSERV. TILLAGE(1) |
| | | MINING/CONSTRUCTION(0) |

BANK EROSION

| L | R | (per bank) |
|---|---|---|
| X | | NONE OR LITTLE(3) |
| | X | MODERATE(2) |
| | | HEAVY OR SEVERE(1) |

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE 0

MAX.DEPTH (Check 1): >4 ft.(6) 2.4-4 ft.(4) 1.2-2.4 ft.(2) <1.2 ft.(1) <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1): POOL WIDTH>RIFFLE WIDTH(2) POOL WIDTH=RIFFLE WIDTH(1) POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply): TORRENTIAL(-1) FAST(1) MODERATE(1) SLOW(1) EDDIES(1) INTERSTITIAL(-1) INTERMITTENT(-2)

COMMENTS: _____

RIFFLE SCORE 0

RIFFLE/RUN DEPTH: GENERALLY >4 in. MAX.>20 in.(4) GENERALLY >4 in. MAX.<20 in.(3) GENERALLY 2-4 in.(1) GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE: STABLE (e.g., Cobble,Boulder)(2) MOD.STABLE (e.g., Pea Gravel)(1) UNSTABLE (Gravel, Sand)(0) NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS: EXTENSIVE(-1) MODERATE(0) LOW(1) NONE(2) NO RIFFLE(0)

COMMENTS: **reach is 100% glide; no pool-riffle-run development is evident; gradient is lower; Little Turkey Lake is within 0.5 miles**

6) GRADIENT (FEET/MILE): 5.3 % POOL 0 % RIFFLE 0 % RUN 0 GRADIENT SCORE 8